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UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA.

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MEMBERSHIP

Professor D. C. Jackson, in the survey of engineering education which he has made for E. C. P. D., found that many members of engineering faculties with the rank of Assistant Professor and higher were not members of this Society. He deplored this situation and suggested that the Society should take immediate steps to remedy it.

President Ferguson has appointed a Membership Committee under the leadership of Jiles W. Haney, University of Nebraska, Lincoln, Nebr. A member of the faculty from each engineering school has been designated a member of this committee but each member of the Society is asked to coöperate. Applications should be sent immediately to Secretary F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Extra blanks will be furnished upon request. The dues are $5.00 a year and checks may accompany applications.

Date.....

THE UNDERSIGNED desiring to become a member of
THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION
hereby agrees to conform to the requirements of membership, if elected, and submits the following:

STATEMENT OF QUALIFICATIONS

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MINUTES OF MEETING OF INSTITUTIONAL DELEGATES

A breakfast meeting of the Council of the Society and the institutional delegates was held on Friday morning, June 23, with Vice-President M. L. Enger, University of Illinois, presiding.

H. E. Wessman, New York University, presented the following:

My task this morning is to present to you gentlemen a brief history of the events relating to the recent attempt in New York State to amend the Engineers' License Law by including two years of liberal arts education as a prerequisite for the Engineers' License. We are all concerned with any political activities of any organization which may directly affect engineering education, and there is nothing to indicate that the attempt made in New York State to fasten a six-year pattern of undergraduate engineering education, including two years of arts education, upon the engineering schools in the State of New York will not be repeated again in that state or in other states.

The proposed amendment was sponsored by Dr. D. B. Steinman, Consulting Engineer of New York City, and a small group of engineers within the National Society of Professional Engineers. This resumé of the history associated with their efforts will be divided into seven short chapters. The first chapter is devoted to a conference held in New York City on October 1, 1938. This conference was called by Associate Commissioner H. H. Horner in charge of higher education of the New York State Board of Regents. Those attending were presidents, deans, and other representatives from engineering institutions in New York State. At this meeting, Dr. Steinman was asked to present his proposal of two years of college study as a preliminary education prior to admission to accredited engineering schools. Mr. Horner then requested discussion from those present concerning the proposal. Dean Barker of Columbia University initiated the discussion by questioning whether educational institutions should be forced to engage in such a program by statutory provision. Representatives of 15 other schools presented similar viewpoints. But this did not deter Dr. Steinman.

My second chapter deals with the activities of the National Society of Professional Engineers at their Annual Convention in Pittsburgh, October 17–19. Let me quote from one of the resolutions passed at this convention:

"Therefore Be It Resolved, by the National Society of Professional Engineers in Convention assembled at Pittsburgh, Pa., on Oct. 19, 1938—That the National Society favors and advocates the raising of the standard of engineering education to a higher level by requiring at least two years of preëngineering college training as a prerequisite for admission to the engineering schools; and

"Be it Further Resolved—That the National Society of Professional Engineers shall do what it can to encourage and speed the attainment of this objective, through persuasion, education, and legislation."

The third chapter is devoted to the dissemination of propaganda in New York State, primarily to members of the State Society of Professional Engineers. Not long after the Pittsburgh convention, a series of monographs prepared by Dr. Steinman appeared on the scene. They were entitled, "Pertinent Facts Concerning the Professions." One was devoted to the medical profession; another to the legal profession; a third to the accounting profession. All stressed the humanistic or cultural training required for each of these professions. Then, on February 25, 1939, a letter was sent to each member of the State Society, referring specifically to the proposed amendment. This letter was signed by Dr. Steinman, and I would like to read the second paragraph from that letter:

"I believe that you will find that this proposed amendment has much to commend it. In general it serves to restate the present qualification requirements in more compact and convenient form while eliminating some troublesome present ambiguities and inconsistencies. There is one, and only one, new feature, however, and that is the inclusion (not as an additional requirement but as a recommended alternative preparation for which a compensating inducement is offered) of a suggestion of two years of pre-professional study in a college of liberal arts and sciences."

You will note that this letter indicates that the new feature is simply a suggestion. Let us see what the actual amendment states:

"The fourth chapter in my resumé deals with the actual amendment which was introduced by Senator Thomas E. Desmond into the New York State Legislature on February 28. Permit me to read the following excerpt from that amendment:

"For license as a professional engineer, evidence must be submitted that the applicant—has satisfactorily completed two years or more of study in a college of liberal arts and sciences registered by the department as maintaining satisfactory standards; has graduated from an accrediting curriculum of four years or more of study in a college or school of engineering registered by the department as maintaining satisfactory standards."

It is evident that this is more than a mere suggestion. In fact, it is virtually mandatory. A subordinate clause at the end of the specific requirements notes that an applicant *may be admitted* to the written examination upon presenting evidence of at least twelve years of practical experience in professional engineering. In evaluating this experience, each complete year of study in a registered college or school of engineering may be accepted in lieu of two years of such practical experience. In other words, an engineering student may graduate in accordance with the present four year plan, but he is admitted to the examination only at the discretion of the Board. It is also worth noting that the proposed amendment grants no credit for graduate study.

The fifth chapter of this short history may be termed "The Awakening of Educators to the Implications of the Proposed Amendment." Copies of the amendment as actually introduced showed that two years of arts

study was virtually a mandatory requirement and if passed would result in radical changes in the engineering schools of New York State, and eventually in other states. Dean Saville of New York University wrote to President A. E. Roche of the New York State Society of Professional Engineers for specific information concerning the proposed measure, and among other things, he pointed out that the matter had never come up for discussion at County Chapters. President Roche, in his reply, referred to the action of the National Convention, and then stated that the matter would come up shortly before the State Convention which was to be held in March. He admitted that County Chapters had not had the opportunity to vote upon the measure, but he pointed out that there was widespread support for the amendment by national engineering societies, including The American Society of Civil Engineers, and also by representatives of State Boards of Examiners. I read the following from his letter:

"At a conference of representatives of State Boards of Engineering Examiners and other interested engineers and educators called by Dr. Chas. F. Scott at the Engineers' Club on January 19, the subject of raising the level of engineering education came up for discussion. Mr. Walter E. Jessup, Field Secretary of the Am. Soc. C. E., informed the conference that four national engineering societies including the Am. Soc. C. E. are ready to ask E. C. P. D. to take the step of establishing one or two years of preëngineering college training as a prerequisite for admission to the engineering schools. Dr. Steinman then outlined to the conference our present proposed amendment and it received the general approval of those present who agreed unanimously that it was the right initial step to take."

Essentially, the same quotations were used by Dr. Steinman at the State Convention. They were also recently published in the April issue of the *American Engineer,* the publication of the National Society of Professional Engineers, in an article by Dr. Steinman.

I took this letter to Mr. George T. Seabury, Secretary of the American Society of Civil Engineers, in order to ascertain if the quotation was correct. He called Mr. Jessup into conference and found that the statement was inaccurate, so he wrote a letter to Mr. Roche, pointing out that the Society had taken no official action upon the matter. Let me read the last paragraph of Mr. Seabury's letter:

"I am sending a copy of this letter to Dean Saville and Dr. Steinman for their information, to make it clear that this Society had made no endorsement of the plan to establish one or two years of preëngineering training as a prerequisite for admission to engineering schools."

A conference held by Dr. C. F. Scott, President, National Council of State Boards of Engineering Examiners, in which there were representatives of various State Boards, engineers, and educators, was also represented as having approved the proposed New York State amendment. Here again, it was necessary to submit the record.* The Executive Committee of the Metropolitan Section of the American Institute of Electrical Engineers also transmitted a resolution to the effect that they were opposed to the proposed amendment.

* No vote taken. Members of only seven Boards present.

The sixth chapter is entitled "The Convention of the State Society of Professional Engineers at Albany." This convention was held on March 10 and 11, 1939. Delegates of County Chapters, for the most part, went to this convention uninstructed and with little advance information concerning the proposed amendment. Due to the activity primarily of some of the staff members of New York University, one of the large County Chapters of the Metropolitan area, however, was informed of the nature of the proposal. The attention of practicing engineers was called to the Society for the Promotion of Engineering Education, a channel through which a healthy evolution of engineering education had taken place over a period of years. They were informed of the Engineers' Council for Professional Development and its possibilities for use as an unbiased medium for a thorough study of engineering education, not only by the S. P. E. E., but by the founder societies. As a result, this Chapter went on record as opposing any mandatory legislation of the nature indicated and they so instructed their delegates to the State Convention. That action and the comments of various educators from other institutions in New York State presented the matter in an entirely new light to many delegates. Consequently, the convention referred the resolution supporting the amendment back to their own legislative committee with a recommendation that it be circulated among County Chapters for further study.

The seventh and last chapter of this history may be called "The Failure of the Amendment and the New Plan." As a result of the action at the State Convention of Professional Engineers and due to active opposition from various parts of the State, the measure was not pushed, and consequently, was not brought out of committee to the floor of the legislature for a vote. Indications are, however, that it will be submitted again, but in somewhat revised form with less emphasis on the mandatory provision for two years of liberal arts education. We naturally are interested in seeing the exact form it takes when re-submitted.

I am delighted to have had the opportunity of presenting these matters to you gentlemen. I believe that it is manifest that engineering educators must, in general, keep in touch with the political activities of any organization that may in any state affect the future of engineering education, to the end that a mutual understanding and enlightenment will result in the evolution of engineering education within our own ranks rather than from without.

In the discussion which followed, W. E. Wickenden, Case School of Applied Science, called attention to the fact that we are dealing with words which are loosely understood, especially the word "profession." As a contribution to the clarification to that end, he suggested "a dual conception, a conception which comprehends an engineering fraternity as well as an engineering profession. The fraternity is a very large and inclusive thing, a rather open body in which any man who can meet certain standards or qualifications of interest and education is welcome but within the engineering fraternity and enveloped by it and nourished by it, is a

more compact and more accurately definable body which is the engineering profession . . . our engineering schools in the large have been servants of the engineering fraternity and, within the fraternity, of its included body the engineering profession."

Continuing he said "We have an immediate responsibility to see that a satisfactory working philosophy of the profession and a satisfactory agreement on terms and their meanings are gradually evolved through the meeting of many minds; also that qualifying standards of the profession and a pattern of education are gradually evolved which do not ignore the fact that the profession lies within a larger and inclusive fraternity, both of which are equally our concern."

After further discussion by R. E. Doherty, Carnegie Institute of Technology; G. M. Butler, University of Arizona; H. P. Hammond, Pennsylvania State College, H. L. Sackett, Emeritus Dean; D. C. Jackson, Massachusetts Institute of Technology; C. F. Scott, Yale University; K. T. Compton, Massachusetts Institute of Technology; C. J. Freund, University of Detroit; and A. A. Potter, Purdue University, the following resolutions were adopted:

(Motion of H. P. Hammond, seconded by W. E. Wickenden.)

In view of current agitation for extending the period and modifying the character of college training of professional engineers, and in view of the fact that certain proposals prominently advocated to this end may be seriously questioned as to their effectiveness in attaining the desired objective, and in view of the fact that the engineering fraternity to which engineering education ministers is a much more extensive and inclusive group than is its member group of professional engineers, and because the problem of the duration and content of engineering curricula is one of great importance and complexity requiring consideration by all groups concerned,

Therefore, Be it Resolved—That a special committee representing the Council and the institutional delegates of the Society for the Promotion of Engineering Education be appointed to give prompt consideration to all the factors involved and to present a preliminary report at a meeting of members of this Society to be held at the time of the 1939–40 winter meeting of the Association of Land Grant Colleges and Universities, representatives of other associations and groups of engineers to be invited to attend the meeting and to participate in the discussion of the problem.

President Compton appointed the following committee:

H. P. Hammond, *Chairman*, Pennsylvania State College
J. W. Barker, Columbia University
F. L. Bishop, University of Pittsburgh
E. S. Burdell, Cooper Union
G. M. Butler, University of Arizona

I. C. Crawford, University of Kansas
R. E. Doherty, Carnegie Institute of Technology
H. J. Gilkey, Iowa State College
W. O. Hotchkiss, Rensselaer Polytechnic Institute
E. L. Moreland, Massachusetts Institute of Technology
H. E. Wessman, New York University
W. E. Wickenden, Case School of Applied Science

A suggestion was made that a committee on matters of legislation affecting engineering education and the engineering profession be appointed. No action taken.

Respectfully submitted,

F. L. BISHOP, *Secretary*

An informal meeting of the Society for the Promotion of Engineering Education, at which this Committee will make a report, will be held in the Willard Hotel, Washington, D. C., at seven o'clock, Thursday morning, November 16, 1939. Breakfast will be served. Make your reservations with F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

REPORTS OF CONFERENCES *

The **Chemical Engineering Division** scheduled two regular conference periods. At the first of these sessions, The Teaching of Thermodynamics and Kinetics was discussed, R. C. Kintner (Armour), the division chairman, presiding; the second session was concerned with the Teaching of Unit Processes, R. N. Shreve (Purdue) presiding. Prior to these specialized conferences the division joined with others in a joint conference on the Place of Management Courses in the Engineering Curricula, M. C. Molstad (Yale) acting as the official chemical engineering representative.

In the past the division has been pleased to report a slight increase in total attendance at each succeeding conference. This year marks not only a new high but one exceeding all previous records by 65 per cent, the number registered being 101, representing 56 institutions.

In addition to the three paper sessions the division held an informal dinner meeting to which the ladies were invited and a luncheon meeting at which all business was conducted.

Papers and Discussion

Tuesday Afternoon: *Joint Conference on Place of Management Training in Engineering Curricula:*

H. M. Hubbard (Harris-Seybold Potter Company), What the Engineer Needs to Know about Management.

M. H. Clark (Boston), Training Engineers to Handle Men.

These papers were presented under the sponsorship of the Industrial Engineering Division. The report of that division will not be duplicated here by extensive report on these subjects.

Wednesday Afternoon: *The Teaching of Thermodynamics and Kinetics:*

B. F. Dodge (Yale), The Teaching of Thermodynamics.

K. M. Watson (Universal Oil Products Company), Kinetics.

These papers dealt with the subjects from the points of view of subject matter, necessity of inclusion in a chemical engineering curricula, and the question of the desirability of the subjects being taught by chemical engineers. The first paper included 51 problems, the last four of which were of a comprehensive type.

* At 47th Annual Meeting, S. P. E. E., Pennsylvania State College, June 19–23, 1939.

M. R. Fenske (Penn State), W. H. Baskervill (Tennessee), and A. H. Cooper (V. P. I.), presented formal discussion of the first paper. These men discussed, respectively, the relation of physical chemistry and thermodynamics as well as the threat of the latter to consume the former, applications of thermodynamics to inorganic industries, and applications of thermodynamics, largely introduced without the student's realization, into the normal unit operations course. The general discussion which followed indicated some disagreement on the proper department in which the subject was to be taught and general demand in the four year undergraduate curriculum for such a course taught by the chemical engineering faculty. Dodge extended his remarks on subject matter. Active in the discussion were Olsen (Brooklyn Poly.), Morgan (Florida), Coates (L. S. U.), Adams (Colorado School of Mines), Stewart (Newark College), and White (Michigan).

W. L. Faith (Kansas State) and C. S. Keevil (Bucknell) led the discussion of the second paper, both men emphasizing the need for problems to aid in the teaching of kinetics. It was noted that industry could be of great aid in this regard. Faith stated that some work on kinetics could be taught in plant design courses, but that, in general, there was little time for the subject's inclusion in the curriculum. In the general discussion, Elgin (Princeton) voiced the difficulty in persuading physical chemists to teach kinetics, as they are less and less interested in the subject. Watson concurred, suggesting that it is becoming the chemical engineer's job, probably in some coördinating course. Giesy (Newark College) also participated in this discussion.

Thursday Afternoon: *Symposium on the Teaching of Unit Processes:*

R. N. Shreve (Purdue), Why Unit Processes.
R. C. Kintner (Armour), Inorganic Unit Processes.
P. H. Groggins (U. S. Dept. of Agriculture), Training Students for Plant Responsibility.
J. Bebie (St. Louis, Missouri), Industrial and Institutional Process Work.
J. Martin (Commercial Solvents Corp.), What the Teaching of Unit Processes Means to Industry.
W. L. Faith (Kansas State), Subject Matter of a Unit Processes Course.
J. C. Olsen (Brooklyn Poly.), Fundamentals of Teaching Unit Processes.
R. N. Shreve and R. K. Toner (Purdue), Unit Process Laboratory.

Considering the relative newness of the unit process conceptions and the great number of both proponents and opponents, it is not surprising that the subject matter of this symposium was extremely varied. Summary of all the papers being impossible in limited space, resort will be made to mere mention of matters which received attention. The first paper dealt with the general topic, attempting to show that classification of reactions into types is desirable. Following papers were concerned with: lack of proper quantitative backgrounds for unit process courses; failure to include all types of reactions, main emphasis being given to "more spectacular organic reactions"; effect of process development lessons on studies of reactions; change of AIChE's definition of chemical engineering to include chemical as well as physical changes in the province of the chemical engineer; the economic and social aspects and problems of industrial work and the resulting requirements which would be advisable in the training of students; the use of industrial type of organization in unit process (and process development) laboratories; the necessary correlation of the unit processes and operations in laboratory work of the former type; and the emphasis upon impurities and by-products, proper equipment, organization, and taking of data in large scale reaction laboratories.

General discussion of the papers centered around terminology, and the contentions that most of the unit process work outlined by the papers is taught at present under different course names, in many instances avoiding duplications of teaching occasioned by the unit process conception. Several members were interested in the conflict between "technology" and the "unit processes" questioning whether the latter might be expected to replace the former. Shreve and D. B. Keyes (Illinois) admitted duplications. The latter stated that course name is not important providing proper essentials are taught and taught well. J. H. Rushton (Virginia) added that since teaching is necessarily a personal matter, inclusion of types of subject matter at definite places in the curriculum must not become standardized; performance is primary, method secondary. Participants in these discussions were Elgin, T. S. Crawford (R. I. State), C. D. Luke (Syracuse), and H. S. Gardner (Rochester).

Additional comments dealt with specific questions upon the individual papers. Matters of laboratory work, number of projects per term, similar courses, and class organization received attention. In addition to the authors of papers, the following men were active in this discussion: White, H. A. Curtis (Missouri), R. A. Fisher (V. P. I.), R. W. Higbie (North Dakota), Morgan, Olsen, E. E. Randolph (North Carolina), H. A. Webber (Iowa State), and K. W. Coons (Alabama).

Prior to the adjournment of the conference, W. A. Koehler (West Virginia), Chairman of the Committee on Resolutions, offered the following motions which were unanimously passed:

"It is moved that the Chemical Engineering Division of the Society for the Promotion of Engineering Education vote its thanks for the courtesies extended to the section by the President and staff of the Pennsylvania State College, and particularly to those members to whom credit is due for the successful handling of the division's local activities.

"It is further moved that the division express its appreciation of the efficient and thorough manner in which the chairman and his associates have evolved and arranged for the presentation of programs of the past three days.

"To those who have presented papers and to those who have contributed to the discussions, the division votes its commendation for the careful preparation and skillful presentation."

Business of the Division

The business of the division was conducted on Thursday, June 22, following a luncheon meeting, Chairman Kintner presiding. The reading of the minutes was omitted since a secretarial report of the Texas meeting had been published in the Journal of Engineering Education (*29*, 176, 1938). The Treasurer reported upon the financial status of the division, showing that the condition was satisfactory, but eventually dependent upon the meeting of expenses of the Summer School to be held at the close of the conference.

After routine committee reports, Molstad, Chairman of the Committee on Joint Conferences, requested that the division continue to coöperate with other divisions upon the Place of Management in Engineering. He stated that such continuation should be dependent upon our more active participation in such meetings than in the past. Continuation of the work was voted with the provision that at least one member of the division appear on any future joint program.

New Business: Rushton proposed to amend the constitution of the Division with the aim of providing a more satisfactory working group on the Executive Committee. The proposed amendments, which were unanimously voted, increased the number of officers by the election of a second vice-chairman, reduced the executive committee personnel to include only the officers and immediate past chairman, and allowed for the appointment by the executive committee of regional representatives to an Advisory Committee.

R. M. Boarts (Tennessee), Chairman of the Nominating Committee submitted the following names for consideration:

Chairman—J. H. Koffolt (Ohio State).
Vice-Chairmen—W. M. Cobleigh (Montana State), P. M. Horton (Louisiana State).
Secretary-Treasurer—J. C. Whitwell (Princeton).

This slate, elected unanimously, constitutes the officers for the year 1939–40.

JOHN C. WHITWELL,
Secretary

SECOND SUMMER SCHOOL FOR CHEMICAL ENGINEERING TEACHERS

At the conclusion of the regular meeting of the chemical engineering division as reported above, the Second Summer School for Chemical Engineering Teachers was held at the Pennsylvania State College. R. C. Kintner (Armour), chairman of the division, served as Director, with F. C. Whitmore (Penn State) and D. S. Cryder (Penn State) in charge of local arrangements. As reported in the News Edition of *Industrial and Engineering Chemistry,* twelve sessions were held, covering topics of Teacher Qualifications, Measurement and Control, Service Courses, Graphical Computations, Introductory Calculations, the Unit Operations (subdivided into eleven topics), Engineering Economy, Correlation of Experimental Data, Chemical Technology, Graduate Programs, Plant Design, Senior Projects, and Comprehensive Problems. No attempt will be made at this time to summarize the material covered, since the major portion of the papers will be subsequently published under the auspices of the Projects Committee of the American Institute of Chemical Engineers.

Testifying to the demand for such a school and the quality of the program as published in advance, is the attendance record. There are 98 registrants, representing 53 institutions, as well as some few, present for a short period only, whose names do not appear upon the official roster. A large majority were present for the entire week of the school. In addition to the technical program, the local committee arranged for exceptionally high grade entertainment in a sightseeing trip, a picnic, dinners, and various forms of sports for the afternoon.

JOHN C. WHITWELL,
Secretary

COMPREHENSIVE EXAMINATIONS

R. L. Sackett, New York, presided at first session; 34 in attendance.

C. E. Bullinger, of Penn State, discussed The Significance of the E. C. P. D. Coöperative Tests and distributed material showing the results obtained over a four-year period. In the discussion C. V. Mann suggested that other elements as well as intellectual capacities need to be tested; Mr. Bridgman believes that a wide range of tests is needed. Mr. Sackett mentions the testing carried on at University of Iowa Missouri School of Mines and Minnesota; describes the testing work at Yale; mentions the linguistic and mathematics tests used in the northeastern preparatory schools. Mr. Sayre calls attention to the correlations that have been made of four years of college grades and high school grades.

At the second session 40 persons were present.

The Chairman, R. L. Sackett, stated that an appeal was being made to the American Council on Education to include engineering tests in their survey. H. W. Bibber, of Ohio State, distributed sample examination questions and described the comprehensive examinations for electrical engineering students at that school. W. H. Formhals presented a paper prepared jointly by him and Bradley Stoughton, entitled Evaluating the Ability of Students to the Work of the Upper Classes in the Engineering Colleges. C. T. Olmsted gave an account of the performance of 108 seniors of the University of Michigan who took the first two days of State Board Examinations in Michigan, just before graduation. Paul Cloke, University of Maine, gave examples of types of questions used there. Comprehensive examinations are given at the end of the sophomore and senior years. The sophomore examinations are called qualifying examinations. They are given in four parts and require two days. They are used to tell whether a student should go on in engineering. Satisfactory performance in senior comprehensives is prerequisite to graduation. University of Maine has exams for E.E., M.E., Ch.E. and C.E. The C.E. examination is taken from the State Board examinations. The Maine Board accepts graduates as having passed examinations over fundamentals and licenses them if they have qualifying experience.

C. V. Mann called attention to the growth of the Committee since its inception at Purdue University in 1931, and suggested that a division of testing be formed.

COÖPERATIVE ENGINEERING EDUCATION

R. C. Gowdy was elected Chairman of the Section for the meeting in June, 1940.

Professor J. E. McDaniel was Secretary of the Section, at which meeting approximately 50 persons attended. Kenneth A. Meade, of the General Motors Corporation, and Karl E. Stromsen, of the National Institute of Public Affairs, delivered papers.

CECIL A. KAPP, *Chairman*

ELECTRICAL ENGINEERING

Two conferences in Electrical Engineering were scheduled in the official program. Both they and the dinner meeting were scheduled for Monday so as to permit any who wished to attend the American Institute of Electrical Engineers convention in California to get there in good time. The attendance at the morning session was about 125, at the afternoon session about 140 and at the dinner meeting about 175. At the first conference, "On the Order of Events" was given by E. C. Woodruff, Pennsylvania State College; "Safe Practices in College Laboratories," by M. S. Coover, Iowa State College. Since Professor Coover's paper is a report of the A. I. E. E. Committee on Safety and is to be published in *Electrical Engineering* in the near future it will not appear in this JOURNAL. The general theme of Professor Coover's paper was that "Accidents Do Not Happen, They Are Committed." He followed this with a very excellent discussion of unsafe practices in laboratories and suggestions for their improvement. This paper was discussed by T. H. Morgan of the Worcester Polytechnique Institute who suggested that accidents could be minimized by building student morale and a feeling of responsibility; C. D. Fawcett, Moore School of Electrical Engineering, suggested an effective method of promoting safety was to make the student pay for all breakage, with joint responsibility of the whole laboratory group; by E. W. Winkler, North Carolina State College, who suggested that faculty members take the National Red Cross safety course; by Moreland King, Lafayette College, who urged that high voltages be kept out of electrical engineering laboratories and also considered building safety morale; by W. G. Dow, University of Michigan, who urged the advantages of eddy current brakes for large machines and viewed with alarm both runaway shunt motors and high voltage; by S. P. Sashoff, University of Florida, who suggested the use of low power communication circuits in the laboratory instead of high power machinery (he admitted however that voltages up to 7 kilovolts were used by his seniors); by S. S. Seyfert, Lehigh University, who felt that the students should be exposed to high voltage so that they will not become contemptuous and careless in the laboratory; by William

A. Murray, Virginia Polytechnic Institute, who suggested that the list price should be put on all apparatus so that the student would realize the value of what he was handling; by H. O. Warner, University of Detroit, who pointed out that all the rules won't help unless a feeling for the apparatus can be instilled in the student and suggested that coöperative education meets this need; by G. B. Hoadley, Massachusetts Institute of Technology, who emphasized the idea of teaching the student the cost of the apparatus; and H. W. Bibber, Ohio State University, discussed a motion picture film which they have prepared giving a dramatization of what can happen in the laboratory if the student is not careful. This last suggestion started a discussion which extended over to Wednesday afternoon.

At an informal meeting on Wednesday afternoon it was moved by Martin C. Hughes, A. and M. College of Texas, and seconded by F. E. Lewis, Cornell University, that a committee be appointed by the new chairman to confer with the Education Committee and the Safety Committee, both of the American Institute of Electrical Engineers, to the effect that the A. I. E. E. appropriate enough money to produce a motion picture film suitable for demonstrating proper and safe laboratory technique. It is desirable that this film be both rented and sold to colleges for the minimum possible amount.

The next paper was on the subject of electrical engineering courses for mechanical engineering students by L. E. Beck, Purdue University. This paper also created an active discussion which was continued in an informal meeting on Tuesday afternoon. This paper and discussion will subsequently be published in the JOURNAL. In the afternoon session two papers were given, The Practice and Teaching of Electrical Design, by T. C. Lloyd, Chief Engineer of Robins and Myers, Inc.; Design and Construction of Experimental Vacuum Tubes in Engineering School Laboratories, by T. S. Gray, Massachusetts Institute of Technology. Both these papers aroused a spirited discussion and required further informal conferences. Professor Gray's was discussed on Tuesday afternoon under the general heading of electronics. Mr. Lloyd's was discussed on Wednesday afternoon. Both these papers will be published with their discussion in the JOURNAL.

The dinner meeting on Monday night was very well attended (about 175 men and women). Elections were held for officers of the section for the coming year. G. W. Swenson, Michigan College of Mining and Technology, was elected Chairman. Knox McIlwain, Moore School of Electrical Engineering of the University of Pennsylvania, was elected Vice-Chairman. Arthur L. Albert, Oregon State College, was elected Secretary. Subsequent to

this, C. R. Stother, University of Washington, spoke on the correction of difficulties in speech. He assured the audience that stammering and stuttering were due to emotional states and could be corrected by an emotional adjustment rather than by any physical treatments.

As noted above, the time originally allotted was not sufficient for the discussions aroused by the papers. Consequently, two informal meetings were held on Tuesday afternoon, one devoted to non-electrical students and one to the teaching of electronics. Each of these was attended by about 25 people. On Wednesday afternoon a further meeting was held wherein teaching of design problems was discussed. The attendance of this was about 35. It is suggested that in arranging for future meetings, a possibility of holding such informal groups be kept in mind.

KNOX MCILWAIN,
Secretary

ENGINEERING ECONOMY

The engineering economy sessions were most successful. The Wednesday luncheon was originally scheduled for the section committee alone, but through misunderstanding was sold out to a flattering total of fifty. Chairman E. L. Grant introduced a stimulating discussion of desirable features for future meetings, first reviewing the section's growth and activities. Of the latter, the principal features have been the evolution of separate section meetings, the engineering economy page of the JOURNAL with which E. D. Ayres has been so successful, and the joint summer conferences with the Stevens Institute of Technology, at Johnsonburg, New Jersey.

The discussions centered chiefly upon the form and content of future meetings. A definite majority favored the separate section meeting, not only because of the difficulties of scheduling, but also to obtain comprehensiveness. Many stressed the importance of promoting additional economy papers in other engineering section meetings as well, comparable to the practice of service departments. A parallel luncheon meeting also was favored to permit the presentation of papers before technical engineering specialists who would otherwise find their group meetings in conflict with our own. Several speakers introduced the desirability of including discussions of teaching problems. Among those contributing to the discussion were: R. Abbott, G. W. Barnwell, D. S. Bridgman, E. S. Burdell, F. H. Crabtree, L. K. Downing, H. P. Dutton, S. B. Lilly, P. T. Norton, Jr., J. C. Olsen, F. H. Pumphrey, and J. C. G. Seidl.

The meeting on Thursday evening was equally successful, despite the inclement weather. The paper by E. D. Ayres, Conflicting Views on the Definition of Engineering Economy, was extremely well received, with many expressions of regret for the author's unfortunate illness and absence. Chairman Grant then introduced the panel discussion of the evening on Teaching Methods for the Course in Engineering Economy, announcing the unavoidable absence of B. M. Woods, J. C. Clark, and J. K. Finch, of the original panel. The discussion was led by F. H. Crabtree, Chairman, C. I. Millard, D. B. Prentice, R. C. Putnam and J. C. G. Seidl.

The first subject in the panel discussion embraced the relative merits of the separate specialized course as contrasted with the improvised integration of economy analysis with technical engineering subjects. The separate course was very definitely favored. As to its position in the curriculum, the senior year was greatly preferred, with a slight advantage expressed for the second semester of that year. Opinions on course presentation universally favored both lectures and case problems and a few added comprehensive term reports upon well known representative jobs. In evaluating course prerequisites, it was generally agreed that the attainment of junior or senior class standing was necessary and sufficient, although approval was expressed of previous familiarity with the principles of general economies.

Following the panel discussion, the audience evidenced a lively interest and contributed many helpful observations. Speakers from the floor included: J. R. Bangs, C. E. Bullinger, G. W. Case, J. E. Crouch, L. E. Conrad, J. E. Hannum, S. B. Lilly and P. T. Norton, Jr.

The popularity of these engineering economy sessions was most gratifying and very promising for our future activities.

ANDREW I. PETERSON,
Secretary

ENGINEERING RESEARCH

The committee on engineering research for the year 1938–39 was as follows:

B. R. Van Leer, North Carolina State College
O. G. C. Dahl, Boston, Mass.
E. R. Weidlein, Mellon Institute
Ernst Weber, Polytechnic Institute of Brooklyn
H. J. Gilkey, Iowa State College

R. C. Ernst, University of Louisville
W. E. Milligan, Yale University
L. G. Straub, University of Minnesota
J. H. Weaver, Ohio State University
F. T. Mavis, *Chairman*, The Pennsylvania State College

The Research Conference included an address by Watson Davis, Director of Science Service, Washington, D. C., entitled "Popularizing Research" and a round table discussion of the functions and activities of the Committee on Engineering Research led by the chairman.

In leading the round table discussion, the chairman stated that the Research Committee of S. P. E. E. has not been restricted in its activities by the Society. Neither has its function been very clearly defined. From time to time it has carried on group studies and arranged conferences from year to year. Perhaps its function may be

(*a*) A wing of the Program Committee.
(*b*) A working committee to carry on special projects. Usually these projects can be handled as—or perhaps more—effectively by the technical divisions. This suggests that the research function might be one of
(*c*) A clearing committee to keep in touch with research projects in the several technical divisions. As a clearing committee, the committee would merely keep in touch with research projects through abstract reports, bibliography clearances, etc. In case of conflict, or apparently undesirable duplication of effort, the Committee might invite trouble for itself by acting as
(*d*) A steering committee to advise as well as to clear information on research in the several divisions.

Because of the close relationship between research and graduate study, it may be considered desirable to enlarge the scope of the Committee's function to include research and graduate study. With this broader scope, the Committee might function more effectively as a working committee (through its own subcommittees) and as a clearing committee coöperating where that seems desirable with the several divisions of the Society. It would, of course, continue as a wing of the Program Committee in arranging its contribution to the conference program.

The following persons took part in the informal discussion: H. J. Gilkey, Iowa State College; F. M. Dawson, University of Iowa; L. E. Grinter, Armour Institute of Technology; J. R. Shank, Ohio State University; H. A. Vagtborg, Armour Institute of Tech-

nology; D. H. Pletta, Virginia Polytechnic Institute; S. P. Sashoff, University of Florida.

The following comments and suggestions were offered: (1) that the Committee consider undertaking a project of tabulating research publications of its individual and institutional members including the listing of Masters' and Doctors' theses in engineering; (2) that space might be available in the JOURNAL for listing these research publications; (3) that the combining of functions to include Research and Graduate Study seemed desirable for effective functioning under a larger scope; (4) that subsidized research projects already reported by other agencies be excluded from the list compiled by the Committee; (5) that industrial research corporations are listed in industrial publications, but apparently there has been little or no coördination of research among the several universities; (6) that lists of bulletins are published by universities from time to time so that pertinent research publications could be listed in a rather limited space; (7) and that the work of the Committee be organized along the lines which have proved to be very effective in the Civil Engineering Division.

F. T. MAVIS, *Chairman*
C. J. POSEY, *Conference Secretary*

ENGLISH

The Conference on English consisted of three sessions. At the first, held on the afternoon of June 19, the following papers or talks were presented: Where Do Correct Language Habits Reside? by Alfred Westfall, Colorado State College; The Problem of the Poorly Prepared Student, by A. M. Fountain, North Carolina State College; Some Experiments in the Teaching of Literature, by J. L. Vaughan, University of Virginia. There were also talks by the President of the Society, Karl T. Compton, and by the Chairman of the Committee on English, E. C. Elliott. A suggestion by Dr. Elliott that required courses in English composition be abolished, the responsibility for correct writing being placed squarely upon the individual student, excited great interest.

At the second session, with Karl O. Thompson presiding, papers were presented by John Mills, Bell Telephone Laboratories, and by W. O. Sypherd, University of Delaware, on English Must Advertise—and How, and Thirty Years of Teaching Technical English to Engineers, respectively. Both papers excited vigorous discussion.

The program for the third meeting, with Miss Sada Harbarger presiding, was presented by representatives of The Pennsylvania State College. The following papers were read: The Relation Be-

tween High School English and College English as a Basis of Work in Engineering, by T. J. Gates; Basal Reading Tests for Engineering Students, by E. A. Betts; and Literature and the Engineer, by W. S. Dye, all of The Pennsylvania State College.

Progress of the Investigation of Instruction in English in Engineering Colleges

There has been a Committee on English in the Society for many years, and groups of teachers of English have met with teachers of engineering subjects and administrators of engineering colleges at each annual convention. The reason for the existence of this Committee was the belief that other organizations of teachers of English were not solving the problems raised by the increasing demand of engineering colleges for students well trained in English. The number of teachers of English attending the meetings was always small, but important work was accomplished under the leadership of C. W. Park, University of Cincinnati, J. Raleigh Nelson, University of Michigan, Miss Sada Harbarger, Ohio State University, and others.

In June 1936, at the convention of the Society at Madison, Wisconsin, the conference on English, sponsored by the Committee on English, petitioned the Council of the Society to authorize an investigation of instruction in English in the technical colleges of the country. This petition was granted, and a new Committee on English, with E. C. Elliott as chairman, was appointed to conduct the investigation. With the aid of Dean Hammond, who was then President of the Society, Dr. Bishop, and others, a grant of $2500 was obtained from the Carnegie Foundation for the Advancement of Learning for the necessary expenses.

At the meeting of the Society at the Massachusetts Institute of Technology in 1937 the English program was devoted mainly to a discussion of the aims and methods of the investigation, but it was not until a meeting of the Committee on English in Pittsburgh in November, 1937, that definite plans were laid. At that meeting it was decided that detailed questionnaires were not desirable but that the ideas of various groups concerned with the problem should be obtained and that all engineering institutions should be asked to describe the methods actually in use. A sub-committee consisting of Dean Greene of Princeton University, Professor Vaughan of the University of Virginia, and Professor Creek of Purdue University was created to collect the preliminary information and to arrange for its publication. Early in 1938 several informal questionnaires were prepared and were sent to engineering deans and presidents of engineering colleges, to heads of departments of English, to instructors in these departments, to

engineering graduates, and to employers of engineering graduates respectively. As replies to these questionnaires were received, they were duplicated for use of the persons preparing various sections of the report, and extracts and summaries were sent to all members of the Committee on English.

At the meeting of the Society at College Station, Texas, in 1938, Dean Hammond arranged a discussion of The Function of the Department of English in the Engineering College which probably attracted more persons than had ever attended an S. P. E. E. meeting concerned with English. Some of the leading engineering administrators of the country participated. It was made clear that only the best teachers and best teaching could meet the requirements of engineering colleges. A real impetus was given to the study in progress.

With the February, 1939, number of the JOURNAL OF ENGINEERING EDUCATION, chapters of the report began to appear. Each chapter has been carefully examined and criticized by the entire Committee and presumably represents, in the main, the opinions of the Committee. At the present time four chapters have been published: The Function of the Department of English in the School of Engineering, by H. P. Hammond, Pennsylvania State College; English Composition in Engineering Colleges, by George Summey, Jr., A. and M. College of Texas; Literature in the Engineering College, by J. L. Vaughan, University of Virginia; and Speech Training in Colleges of Engineering, by Donald Hayworth, Michigan State College. Two additional chapters will be published in the JOURNAL soon: Teachers of English in Engineering Colleges: Selection and Training, by H. L. Creek, Purdue University; and Organization of Teaching Conditions in Departments of English in Engineering Colleges, by Otto Birk, University of Colorado.

In May, 1939, a second meeting of the Committee on English at Pittsburgh took stock of what had been accomplished and made plans for the future. The Committee decided that it would be desirable to add a chapter on methods and devices that had been found particularly successful in various institutions of the country so that all institutions should be made aware of them. It discussed the importance of the final chapter of the report, which is to embody the conclusions, and asked Dean Hammond, author of the introductory chapter, to prepare also this last chapter. Finally, it was made evident that the report itself will be a beginning only: that steps must be taken to improve the quality of English staffs in the engineering colleges, to increase the interest and perhaps the active participation of engineering faculties in the teaching of English, and to provide vigorous and continued experimentation.

INDUSTRIAL ENGINEERING

The conference sessions on Industrial Engineering were arranged around the following breakdown of its interests:

1. *Methods.*—Tool engineering, motion and time study, factory planning.
2. *Cost Control.*—Cost accounting, budgetary control and standard costs.
3. *Personnel.*—Psychology and industrial relations.
4. *Coördination.*—Industrial organization and administration and scientific management.

A most successful dinner meeting was held which was attended by ninety-five persons. The subject for the dinner meeting was the Thirtieth Anniversary of the Curriculum in Industrial Engineering. Thirty years before or in 1908 and 1909, Hugo Diemer became head of the Department of Industrial Engineering at The Pennsylvania State College and inaugurated the first curriculum in Industrial Engineering.

R. L. Sackett, Dean Emeritus, Pennsylvania State College, presided as toastmaster at the meeting. He, having come to Penn State shortly after the establishment of the curriculum, told of its development. J. O. Keller, now Assistant to the President at Penn State in charge of Extension and at one time Head of the Department of Industrial Engineering and previous to that one of its first graduates, told in an interesting way intimate stories of Professor Diemer. At the close of his remarks the group stood for a moment in memory of Mr. Diemer who died shortly before the convention.

C. W. Lytle, New York University, brought up-to-date the paper on the Development of the Teaching of Management to Engineers which he reported on several years ago. He showed that the work has had a steady growth in number of curricula and in the number of students. He also called attention to the fact that further increases may be expected since the curriculum had been accredited by the Engineers' Council for Professional Development.

The extent to which industrial engineering has developed in industry was vividly presented by S. M. Lowry, Proctor and Gamble Company, who was also one of the early graduates at Penn State. The picture he gave of the industrial engineer in modern industry was that of an analyst, trouble-shooter and research man who functioned in the fields of production and manufacture having to do with manufacturing processes and their physical human and monetary aspects. He illustrated his meaning by describing the study of "floor mopping" as done by an in-

dustrial engineer in his company, showing that the result of the study was a new standard of performance at a saving in cost and with lessening of worker fatigue.

Dean Kimball, Cornell University, completed the program by looking into the future for those concerned with the teaching of management to engineers. He saw the need to make the engineer more human so that he would be able to deal more adequately with those problems of management which affected the worker and which are becoming more and more complicated because of the effect of governmental legislation on the relationships between worker and management.

A very successful session was held on The Place of Management Training in Engineering Curricula. This was a joint session with civil, electrical, chemical and mineral technological curricula. The attendance was such that it overflowed a classroom whose normal seating capacity is 140. Two very excellent papers were given by two men from industry, Howard M. Hubbard, Harris-Seybold Potter Co., Cleveland, Ohio, spoke on What the Engineer Needs to Know about Management. Myron H. Clark, of Boston, Mass., spoke on Training Engineers to Handle Men.

On Wednesday a session was held which had for its principal topic the curriculum in Industrial Engineering and related designations. It was attended by 51 persons. C. W. Lytle presented a report on Nomenclature. The basis for this report is the need which has been felt for a standardization of the terminology of management. This report is the beginning of a movement to clarify the meanings of numerous terms in management which have and are being used quite loosely. It is to be a continuing study.

L. P. Alford presented an outline of the recently created curriculum in Administrative Engineering at New York University. G. A. Maney presented for discussion his paper, Industry Evaluates the Industrial Engineering Curriculum, which was printed in the June, 1939, issue of the JOURNAL.

The papers for the two other sessions were built around an outline analysis of a course of study. It was thought that the answers to the several questions would assist those attending the sessions to picture just how the subject was taught at several institutions. The outline analysis is as follows:

A. Catalog number and description of course.
B. Aims and objectives of the course. An amplification of the catalog description.
C. Text books, reference books and collateral reading.
D. Students who take the course.
    a. Year or class.

b. Curriculum.
c. Required.
d. Elective.

E. What specific preparation is required of students taking this course?
This refers not only to the specified pre-requisite but also to the reason for its place in the curriculum.

F. Does the course specifically prepare for any other course? If so, what?

G. What specific topics are covered in the course?

H. What apparatus or equipment do you use in teaching this course?

I. What auxiliary aids, such as lesson outlines, notes, problems, charts, lantern slides, motion pictures are used in teaching this course?

J. What teaching methods do you use in the teaching of this course?
a. Discussion of lesson before text-book assignment.
b. Discussion of lesson after text-book assignment.
c. Lecture.
d. Oral recitation.
e. Daily ten-minute quizzes.
f. Periodic examinations.
g. Final examinations.
h. Supervised practicum.
i. Independent practicum.
j. Outside readings.
k. Book reports.
l. Home work problems.
m. Reports.
n. Seminar or discussion periods.

The first of these sessions was held on Monday. E. L. Grant discussed Methods for Teaching Cost Control. C. W. Beese discussed Methods for Teaching Personnel and Industrial Relations.

The last session was on methods. Professor Thuesen, Oklahoma A. & M., had prepared in accordance with the suggested outline analysis, the data for the methods subjects as taught at six or seven of our colleges. It was a most interesting document and one which will serve as a source of information to those teaching such courses. At this session the work of the industrial engineer in industry was presented by J. A. Hagan, Carnegie-Illinois Steel Company, in a very interesting and enlightening manner. Professor Porter, New York University, illustrated the Teaching of Motion and Time Study by numerous motion pictures including one of an appendicitis operation. Professor deZafra described a course in Jig and Fixture Design and gaging. He also told of the

work of the gaging station located at New York University by the Ordnance department. C. W. Beese, Purdue University, gave a short talk on gadgets that have proved useful in these laboratory courses.

The Committee on Industrial Engineering discussed plans for future meetings. It believes that besides its own interests it has other outside interests which it recognizes as meriting the taking part in joint conferences. It has, therefore, planned that at future meetings it will coöperate with joint conferences as follows:

1. Engineering economy.
2. Manufacturing processes.
3. Other curricular groups on the place of management teaching.

The committee authorized the appointment of a sub-committee on Nomenclature to coöperate with Professor Lytle who was made chairman of this committee. He is to pick his own committee.

Some discussion was held concerning a more formal form of organization of those interested in Industrial Engineering and its related interests.

The committee is desirous to make its program useful and attractive to all those who are in any way interested in the teaching of management to engineers, irrespective of whether or not they have a curriculum in industrial engineering, administrative engineering or a curriculum having other designation or none at all. It further seeks the coöperation of the members of the Society by asking all those who are interested in this field whether or not they are listed in the membership list under Industrial Engineering to communicate that fact indicating their special interest to the secretary of the committee, Asa S. Knowles, Northeastern University, Boston, Mass. The committee wishes further to thank all that took part either in presenting papers or in the discussions.

C. E. BULLINGER,
Chairman

INSTRUCTIONAL METHODS

A conference was held by the Committee on Instructional Methods at a luncheon meeting Tuesday, June 20, when George E. Tomlinson of the TVA presented the Use of Motion Pictures in Engineering Education. R. W. Morton, University of Tennessee, presided. The meeting was well attended and there was active interest on the part of all those present in the subject under discussion.

After Mr. Tomlinson presented his paper, H. J. Gilkey, Iowa State College, pointed out some difficulties which presented them-

selves in the use of motion pictures, such as inconvenience in interrupting the complete story for discussion of different points presented by the film. He spoke of the advantage to be gained in the use of motion pictures as a substitute for inspection trips where colleges and universities are located at a distance from industrial plants. He felt that the subject was well worth further study.

R. L. Spencer, University of Delaware, stated that they had used films frequently in their classes but that he personally liked the silent better than the sound films since he prefers to give the explanations personally. He stated that he saw no objection to a reasonable amount of advertising such as appears frequently in industrial films. He did object to the lack of the use of professional terms in the endeavor to make industrial films presentable to persons without technical training. He also pointed out that the films did not often lend themselves to the changes which were constantly going on in professional practice.

Max M. Frocht, Carnegie Institute of Technology, pointed out that most of the films were quite elementary, descriptive in nature, interesting and acceptable for a first presentation of the subject but in general were not very helpful for advanced students.

William R. Bryans, New York University, and Forest C. Dana, Iowa State College, also participated in the discussion. Professor Dana stated that one first principle to consider was whether or not motion is necessary in the study under consideration.

The following resolution was adopted:

Those assembled at the meeting devoted to a consideration of the use of the Motion Pictures in Engineering Education sponsored by the Committee on Instructional Methods have considered the studies of this subject made by members of the Society during the past four or five years. Based on these discussions, studies, and other sources of information, the proper use of motion pictures is recommended as a definite aid to engineering education.

It is thought that the S. P. E. E. should take the initiative in promoting a visual education program rather than leave such work undone or to be done partially by the national organizations in the different specialized fields of engineering.

The creation of a Committee on Visual Education is recommended. This committee should be either a new committee or a sub-committee of the present committee on Instructional Methods. It should sponsor the preparation of approximately 12 programs in each of the following fields:

Engineering orientation
Basic engineering sciences
Chemical engineering
Civil engineering

Electrical engineering
Mechanical engineering

Other phases of engineering may be entered after the programs in those fields have been substantially completed.

Each of the individual programs would consist of three parts:

1. Selection and preparation of suitable quantities of pamphlets and reprints of articles so that the students in a class could study the material concurrently.
2. A motion picture program, approximately 20 minutes in length, presenting the theory and application of the subject in question.
3. An adequate system for evaluating the effectiveness of the program.

The first and third parts, while important, are relatively easy and inexpensive to prepare; however the review of all available film and the preparation of proper programs for engineering teaching purposes may involve much more time and expense. This is especially true because in many cases obnoxious advertising will have to be deleted and occasionally additional remarks and explanations will have to be added to the film. Suitable film will not be available on some subjects, in which case it will be necessary to secure a sponsor for such a program. Ultimately, it may be necessary for the S. P. E. E. to undertake the production of several programs. Initially, the principal task will be the selecting of the most suitable of the existing motion picture programs and filling in the projected outline of the over-all programs as new films are released by various industries and organizations.

The handling of the distribution features of such a program will ultimately become complicated, requiring some definite arrangements for handling it. However, during the formative period the proposed Visual Education Committee should administer all the details of the program.

No estimate of the cost of the entire program has been made, but it is thought that at least the first 18 of the proposed 72 programs can be completed with the following expenditures:

1. Clerical and stenographic For carrying on correspondence with industries, engineering societies, foundations, and others interested in the production of film and for typing bibliographies, evaluation programs, etc.	$ 100
2. Printing Reprints, questionnaires, pamphlets, etc.	$ 150
3. Purchase of Copies of Films Some films may be donated, but it will probably be necessary to purchase copies of most of the films selected at nominal reprint costs.	$ 350
4. Film Editing It will be necessary to delete obnoxious material, standardize titles, and occasionally purchase extra scenes to clarify the presentation.	$ 600
Total	$1200

It is believed that the first 18 programs can be prepared at such low costs, because the first programs selected will include those existing films which are most suitable for teaching purposes. As additional programs are added to the series, the unit cost of the programs will be increased.

A second meeting was held on Tuesday afternoon. After brief comments by Chairman Ell, Professor Knowles of Northeastern read the paper prepared by Professor White of Northeastern relating to Teaching Loads versus Teaching Methods. Professor Clarke of Ohio State was the chief speaker in the discussion—his principal comment being that he found nothing in Professor White's paper which would help him (Professor Clarke) in a revision of the teaching loads in his department.

The paper by Professor De Baufre was read by Professor Marmo of Nebraska. This paper created considerable discussion, particularly with reference to the subject of what constitutes a good teacher, and also what use advanced degrees have in guaranteeing a good teacher. Dean Spencer of Delaware spoke at length in the discussion and emphasized classroom solutions of problems by students. Professor Armstrong of Cornell, Ketchum of Case, Folk of Ohio State and Alexander of Northeastern all participated in the discussion. Most of the discussion in these cases had to do with the Lecture Method versus the Recitation Method, all being tied up with the size of the class and the caliber of the students.

Professor Boomsliter's paper was next on the program. In this excellent paper he emphasized the importance of correlating classroom work with the laboratory to the extent that the testing materials laboratory is so definitely tied up with mechanics that the two should be given simultaneously and with more correlation than is used in most of the schools. Professor Lightburn of Iowa State College and again Professor Clarke of Ohio State were the chief discussers. The general thought brought out in these discussions was that the teaching of Applied Mechanics could be materially enhanced by the use of small models which would adequately portray or describe certain fundamentals in the strength of materials. The whole group seemed to be much in agreement with these ideas.

The fourth paper by Professor Frocht, Photoelastic Demonstrations as Teaching Aids, made a plea for the use of photoelastic methods in classroom work. He emphasized the simplicity of the method, and showed how inexpensive equipment could be used very effectively for the particular work at hand. Slides and models closed his talk.

CARL S. ELL,
Secretary

MATHEMATICS

The first conference of the Mathematics Division was a joint conference with Mechanics. Two of the papers were presented by members of the Mechanics Division, and will be reported by that Division. They discussed the mathematical difficulties of the students taking courses in elementary mechanics and the courses and topics in mathematics which are prerequisites for courses in advanced mechanics.

Tomlinson Fort in discussing the changes in mathematics courses necessary to help the students in their mechanics courses advocated two things:

1. A preparatory course in mechanics taken in the freshman year and taught by the conference method.

This course would be much more elementary than the courses now given in elementary mechanics, and should react on the mathematics courses to their betterment.

2. A curriculum with a major in engineering with specialization in mathematics.

In this curriculum he would include all basic engineering courses, but without specialization other than in mathematics and mechanics. He would urge future teachers of mathematics to take this course and follow it with graduate courses in mathematics. He would also urge future teachers of engineering to take it and then take graduate courses in their speciality.

In the second conference three papers were presented and discussed. The following is a summary of their contents.

Alan Hazeltine presented the facts and the underlying philosophy of a course given the past year at Stevens Institute. This course attempted to give to the freshmen the basic facts and principles of physics and the mathematics necessary to interpret them.

Professor Jonah discussed the attitude of a professor of mathematics in an Arts College towards courses which prepare students for work in engineering subjects. His experience at Western Reserve University has led him to the conclusion that the instructor in mathematics should make himself familiar with the basic facts of such subjects as physics and chemistry, both elementary and advanced, and on a basis of this knowledge should build useful courses in mathematics.

J. W. Cell reported on the work of the committee appointed to collect engineering problems for use in classes in mathematics. He reported that about three hundred problems had been collected from text books on engineering subjects, from technical magazines and from interested engineers. The committee needs the

coöperation of all teachers of technical engineering subjects if this project is to accomplish its objective, namely, better teaching of mathematics to engineering students.

J. H. WEAVER,
Secretary

MECHANICS

The opening session of the Mechanics Division meetings was held Monday morning with H. J. Gilkey, Iowa State, Chairman, presiding. R. K. Bernhard, Head of the Department of Mechanics at Penn State welcomed the visitors. The first paper, Engineering History and the Cultural Background, was by Robert H. Carey, Penn State. Mr. Carey pointed out the desirability of giving the engineering student more than technical skill, of giving him a pride in engineering achievement, and instilling in him the why of engineering. He stated that a course in history of engineering would aid in the achievement of this end by identifying the enbryonic engineer with the traditions of his field, by giving him a broad view of the aspects and problems of engineering from a genetic and developmental point of view, by providing a basis for a constructively critical attitude towards engineering as a profession, and by emphasizing the cultural aspects of engineering. He pointed out the possibility of using the "engineering interest" material as a background in a course which would develop the engineering student's written and spoken English and at the same time give him something of the cultural aspects of engineering. The proposed course should be given concurrently with or following courses in analytical mechanics or strength of materials, and should have a definite coördination with engineering.

In the discussion which followed the presentation of the paper, it was agreed that liberalizing training including a better grounding in English would be of value to all engineering students, although engineering students are not as devoid of culture as they are popularly pictured to be. M. F. Sayre described briefly a plan in use at Union College designed to give the students a better appreciation of non-technical material.

C. J. Posey, University of Iowa, presented a paper entitled, An Experiment in Teaching Methods for the Course in Materials Laboratory. The experiment reported by Professor Posey was a modification of the technique reported in a thesis The Function of the Laboratory in Engineering Education by J. S. Peck, C. C. N. Y., and presented at the Cambridge (1937) meeting of the Mechanics Division. As Professor Posey felt that it was neither necessary

nor desirable to have the students do as much original planning and experimentation as Doctor Peck proposed, he included, at the end of the term following the usual type of well-outlined laboratory problems, one experiment selected or devised by the individual squads in whatever phase of testing they desire. With a minimum of assistance from the instructor the students plan and conduct the experiment, and then, in addition to the usual written report, present an oral report before the entire class. With three semesters trial of the plan, Professor Posey reports a much better correlation between quality of work done on the final examinations and the final experiments than between the final examinations and the other experiments for which complete instructions are given.

It is felt that one problem of this type per semester is sufficient for the average engineering student. Following the presentation, copies of a laboratory final examination used at the University of Iowa were distributed, and also copies of a typical final used at Iowa State College.

The discussion covered several phases of the laboratory teaching, including the necessity of making the laboratory courses efficient because of the high cost of instruction, the lack of correlation between the different phases of the laboratory instruction, and the writing of reports. Of the sixteen institutions represented, two have squad reports, ten have individual reports written outside of the laboratory, and four call for individual reports written in the laboratory. The desirability of making the reports critical rather than narrative in character was pointed out.

An open forum was held on the topic, The Final Examination in Relation to Such a Course as that in Materials Testing. The difficulties of preparing a final examination which adequately covers all phases of the laboratory course were discussed. Eight schools reported that final examinations are required in materials laboratory, three have finals combined with other courses, one excuses men whose laboratory work has been passing, and one excuses all men.

In the afternoon the Mechanics Division held a joint session with the Machine Design group, with Edgar MacNaughton, Chairman of Machine Design, presiding. An unusually interesting paper, The Development of New Products, was presented by A. R. Stevenson, Jr., of the General Electric Company. Dr. Stevenson discussed the origin of ideas for new equipment and traced the channels through which the ideas must pass before they assume the tangible form of marketable products.

His paper was followed by a forum on the Function of Mechanics with Respect to Machine Design, which was led by F. L. Eid-

mann, Columbia University. Professor Eidmann pointed out the close relationship between mechanics and machine design and stressed the desirability of the prerequisite mechanics emphasizing the basic principles so the student would have a better foundation upon which to build his work in machine design. Prepared discussions of his presentation were offered by A. W. Luce, Lehigh University, D. H. Pletta, V. P. I., and E. S. Ault, Purdue. They pointed out the advantages, to the student particularly, of having a consistent nomenclature and set of symbols in the two courses, and the importance of teaching methods instead of formulas in mechanics.

Tuesday afternoon, June 20, the Mechanics Division had a joint session with the Division of Mathematics, with Alan Hazeltine, Stevens Institute, Chairman of the Mathematics Division, presiding.

Discussion on one phase of the relationship between mathematics and mechanics was opened by G. N. Cox, Louisiana State University, who spoke regarding the Mathematical Difficulties Encountered by Students in Elementary Mechanics. He stated that in most cases the quantity of material covered in algebra, trigonometry, analytic geometry, and calculus is sufficient, but that the students need more drill in the analysis of problems rather than the routine methods of solution. The thought processes and methods of analysis which are used throughout mechanics should be learned in mathematics where they are first encountered.

The next paper presented was Topics and Courses in Mathematics Which Are Desirable Prerequisites for Advanced Courses in Mechanics by N. C. Riggs, Carnegie Tech. With reference to the graduate courses taught in the evening school at his institution Professor Riggs recommended higher algebra, advanced calculus, and ordinary and partial differential equations as the necessary prerequisites, pointing out the use of various parts of these courses in solving problems which are usually encountered in advanced courses in mechanics.

Tomlinson Fort, Lehigh University, led the discussion on necessary or desirable changes which would make the mathematics courses more effective in mechanics. It was suggested that some work in mechanics be incorporated in the mathematics courses, that the two be given simultaneously, or that the necessary mathematics be taught in the mechanics course as it was needed. The various suggestions presented from the floor provoked considerable discussion and indicated that several novel plans are being tried at various institutions.

The annual dinner of the Division of Mechanics was held at Skytop Inn on Tuesday evening, with over a hundred in attend-

ance. H. J. Gilkey, Iowa State, retiring chairman, presented a brief report concerning the activities of the Division, and introduced S. C. Hollister, Cornell University, who spoke on The Place of Mechanics in Our Expanding Industries.

F. G. Switzer and P. G. Laurson were elected to the Executive Committee to succeed the retiring members, W. J. Cox and H. J. Gilkey. The Executive Committee is now constituted as follows:

T. J. Dolan (University of Illinois)	term expires 1940
S. B. Folk (Ohio State University)	term expires 1940
W. B. Johns (Georgia Tech)	term expires 1941
C. M. Olmsted (University of Michigan)	term expires 1941
A. S. Adams (Colorado School of Mines)	term expires 1942
G. N. Cox (Louisiana State University)	term expires 1942
P. G. Laurson (Yale University)	term expires 1943
F. G. Switzer (Cornell University)	term expires 1943

Committeeman A. S. Adams was elected Chairman of the Division.

GLENN MURPHY,
Conference Secretary

MECHANICAL ENGINEERING

The Mechanical Engineering Division held two general sessions of all the groups; a joint session of Engineering Mechanics Division and the Machine Design Group; a joint session of the Heat Power Group and Mechanical Laboratory Group; a session of the Machine Design Group; an informal dinner; and a luncheon. The meetings are believed to have a larger attendance than at a preceding convention. All meetings had an attendance of at least a hundred persons, and two of the sessions had an attendance of 150.

At the last general session the chairman, Jiles M. Haney, announced the officers and committees for 1939–1940. (This list appears in the September JOURNAL OF ENGINEERING EDUCATION.)

Paul Eaton, Lafayette College, presided over the Machine Design Group and introduced Louis J. Bradford, Pennsylvania State College, who presented a very interesting paper on Teaching of Lubrication and Bearing Design. James I. Clower, Virginia Polytechnic Institute, very ably discussed Professor Bradford's paper after which the general discussion was entered into by members of the group.

Edgar MacNaughton, Tufts College, presided over the Joint Session of Engineering Mechanics Division and the Machine Design group. A. R. Stevenson, Jr., General Electric Company,

presented a very interesting paper on The Development of New Products. Dr. Stevenson emphasized that the type of man required for the development of new products is very difficult to find and that the inventive type of engineer is much more valuable in this type of work than the analytical engineer. Dr. Stevenson was followed by Professor Eidmann, who was leader of a Forum on The Function of Mechanics with Respect to Machine Design. Professors Luce, Pletta and Ault discussed the subject.

Chairman Jiles M. Haney presided at a general session sponsored by the Heat-Power Group and the Mechanical Laboratory Group. Ben G. Elliott, University of Wisconsin, presented A Survey of Heat-Power Engineering Courses in the United States. Professor Elliott very ably summarized the results of the survey and pointed out some very interesting facts concerning the teaching in the various institutions. The survey was based on questionnaires which were sent to about 100 institutions. About 80 per cent of the institutions returned the questionnaires. The accumulated material, a stack about two feet high, was left for interested persons to examine. It is hoped that some method can be found by which the vast amount of information compiled by Professor Elliott may be made available to all interested instructors in the various institutions.

G. L. Tuve, Case School of Applied Science, led the discussion on Correlation of Classroom and Laboratory Work in the Heat-Power Field. H. W. Blackburn, Syracuse University; J. B. Jones, Virginia Polytechnic Institute; and P. E. Mohn, University of Illinois, all very ably discussed the subject.

The second general session was sponsored by the Manufacturing Processes Group. Chairman Jiles W. Haney introduced R. L. Sweigert, Georgia School of Technology, who led the discussion on the subject: Do Instructional Methods Used in Manufacturing Process Laboratories Contribute to Trade Training or to Engineering Education? The following persons discussed the subject: C. W. Crawford, A. & M. College of Texas; O. W. Boston, University of Michigan; L. J. Lassalle, Louisiana State University; M. M. Boring, General Electric Company; C. H. Casberg, University of Illinois; M. P. Cleghorn, Iowa State College; L. G. Miller, Michigan State College; C. W. Ham, University of Illinois; F. L. Eidmann, Columbia University; A. L. Townsend, Massachusetts Institute of Technology; and E. MacNaughton, Tufts College. Arthur B. Domonoske of Stanford University presented the discussion for B. M. Woods, University of California, who was unable to attend on account of illness.

At an informal dinner, Jiles W. Haney, University of Nebraska, presided. David L. Arm, Purdue University, presented

A Study of Gears, illustrated with motion pictures. The motion pictures taken in plants of various manufacturers led to a discussion as to the value of motion pictures in engineering education.

At the informal luncheon, which was a reunion of those who attended the S. P. E. E. Summer School in Mechanical Engineering at Purdue University in 1929, but to which everybody was invited, Chairman Haney introduced A. A. Potter of Purdue. Dean Potter played his ocarina and was accompanied on the piano by Professor Lindley of Purdue.

Dean A. A. Potter, Purdue University, awarded a P.G.S. (pretty good scout) medal to Dean H. P. Hammond, Pennsylvania State College, for his ability to pitch copper coins and his valuable work in engineering education.

C. H. CASBERG,
Secretary

MINERAL TECHNOLOGY

The 47th Annual Meeting included the most extensive program that the Division of Mineral Technology has thus far enjoyed. The attendance at the sessions was likewise the largest; the total of 44 individuals who were present at one or more of the meetings included 23 members and 21 guests. It is to be hoped that we may have an opportunity to welcome many of the latter as members before another meeting has convened.

Three luncheons and three conferences comprised the program. The first gathering was Monday's luncheon at the University Club, which a downpour of rain failed to dampen. Adjourning to the Mineral Industries Building, the group held its first conference with R. S. McCaffery (Wisconsin) as chairman. All the conferences of the Division were held in this building, a splendid example of the best in facilities for mineral industry education, which many of those present took the opportunity of inspecting.

Undergraduate Laboratory Instruction in Metallurgy was the theme of the first conference. Professor McCaffery introduced the subject with a discussion of independent vs. directed work on the part of the student. J. L. Bray (Purdue) described the extensive summer laboratory course required of all his metallurgical students. He spoke of the development of morale and said that the requirement of summer work had not reduced the number of students. He also said that an English instructor is employed full time for work in connection with engineering reports. D. F. McFarland (Penn State) discussed correlation of laboratory work with lectures. C. Upthegrove (Michigan) discussed the balance

between individual work and group instruction. Aids suggested for the problems arising from overcrowded laboratory sections included staggering of experiments so that only a few men work simultaneously on the same one, employment of graduate assistants, and holding one meeting per week of the entire class for instruction which would enable each student to work largely independently for the remainder of the time. H. L. Walker (Illinois) presented an analysis of the metallurgical curricula of 32 colleges, showing the number of credit hours devoted to each subject. Only four subjects—chemistry, physics, mathematics, and English—are required at all of the 32 colleges. The subjects required in 90 per cent or more of the curricula are drawing, mineralogy or geology, mechanics, electrical engineering, ferrous metallurgy, and metallography. Others besides those mentioned above who took part in the discussion included T. T. Read (Columbia), Bradley Stoughton (Lehigh), E. H. Comstock (Minnesota), G. E. Doan (Lehigh), K. H. Donaldson (Case), O. B. Malin (Penn State), A. Butts (Lehigh), M. Gensamer (Carnegie Tech.), F. N. Rhines (Carnegie Tech.).

At the Tuesday luncheon, a portion of the group met in a special session for coal mining men. At the close, both groups combined and listened to an interesting talk by T. T. Read on the beginnings of engineering education and especially the important part played by mineral technology; his paper will be published. A discussion of it followed.

On Wednesday, the luncheon held at the Hotel State College was made the occasion of our business meeting. Bradley Stoughton, Chairman of the Division, presided, and 33 were present. Election of officers for the coming year yielded the chairmanship to R. S. McCaffery (Wisconsin), while A. F. Greaves-Walker (North Carolina State) was re-elected Vice Chairman. Instead of electing a secretary, the new chairman was authorized by vote to appoint one. Dean Stoughton said that much remains to be done in building up the Division. The secretary expressed the hope that the success of the meeting at Penn State would stimulate an increase of membership. G. M. Butler (Arizona), W. R. Chedsey (Missouri), and W. B. Plank (Lafayette) discussed geological engineering. T. T. Read said that the correlation between geology and mining should be preserved. There was considerable discussion of accrediting of curricula, and a motion was passed authorizing the new chairman to appoint a committee of three to consider matters dealing with accrediting and to be at the disposal of E. C. P. D. for advice concerning mineral technology curricula. D. F. McFarland suggested the desirability of another summer school for teachers of mineral technology. J. F. Oesterle

(Wisconsin) discussed the arrangement of meetings, and Dean Stoughton read the list of committee chairmen, who have been largely responsible for programs. On motion of Professor Plank, a Committee on Terminology was authorized, the chairman to be appointed by Professor McCaffery and to choose his own associates to any number desired. It was suggested that the committee might prepare a glossary of special terms in the field of mineral technology education, in regard to some of which there is now considerable confusion. Professor Plank suggested holding an annual dinner of the Division at the S. P. E. E. annual meeting.

The Wednesday afternoon session was arranged by A. F. Taggart (Columbia), who presided. The principal topic was education in mineral dressing, some phases of which, Professor Taggart stated, are being neglected by the mineral technology field and taken over by chemical engineers and others. He discussed the returns from a questionnaire sent to various mining schools regarding the status of mineral dressing, its scope, and the opportunities for employment in it. He believed that its field should be broadened. W. B. Plank (Lafayette), T. T. Read (Columbia), E. B. Shorey (Wisconsin), and W. R. Chedsey (Missouri) also discussed this question. M. M. Stephens (Penn State) pointed out that petroleum refining is based largely on organic chemistry and believed that it belongs more properly under chemical engineering than under mineral dressing. K. M. Donaldson (Case) presented a paper entitled A Proposed Curriculum Leading to the Degree of B.S. in Mineral Technology. E. H. Comstock gave a valuable report on A Study of the Activities of Graduates of the School of Mines and Metallurgy, University of Minnesota, covering the occupations of about 700 men who have graduated since 1894. J. L. Bray gave some conclusions reached as a result of interviews with 110 industrial executives; the weight of opinion is decidedly against specialization in engineering education, and against too wide extension of graduate work. E. C. Miller (Purdue) presented a tabulation of the proportion of time devoted to mineral dressing in mining and metallurgical engineering curricula at 34 colleges. The proportion varies from 0 to 6 per cent, averaging 2.9 per cent in the metallurgical and 3.4 per cent in the mining curricula. A paper on Specialized Curricula in Mineral Dressing by P. C. Emrath (Kentucky) was given by title in his absence; it is hoped that this will be published later.

On Thursday afternoon a session devoted to an informal round-table discussion of graduate work in metallurgy was held under the leadership of Professor McCaffery. Possibly our program was spread over too many days, as only a few could attend this final meeting, the nature of which, however, was well suited for a small

group. Others who spoke at this session included D. F. McFarland (Penn State), M. A. Hunter (Rennselaer), K. H. Donaldson (Case), H. V. White (Virginia Polytech.), W. E. Milligan (Yale), C. H. Samans (Penn State), H. P. Nicholson (Illinois), H. L. Walker (Illinois), and M. Bolotsky (Virginia Polytech.).

The social contacts afforded by the meetings were a valuable feature. Along with good attendance and the stimulus of the broad program of education and research in mineral technology conducted at Penn State, they combined to make an enjoyable and successful meeting.

ALLISON BUTTS,
Secretary

PHYSICS

Two conferences were scheduled for the annual meeting of the Physics Section. An unscheduled joint meeting with the Mathematics Section at the invitation of the Mathematics group proved to be interesting.

Papers were presented at the first conference on Monday afternoon by C. E. Bennett of Maine University on Intermediate Physics in the Engineering Curriculum and by E. W. Thomson of the U. S. Naval Academy on Advantages of Naval Academy Instruction. Both papers called forth a lively discussion on the problems of teaching physics to technical students.

Papers were presented at the second conference on Thursday afternoon by S. C. Hollister, Cornell University, on Physics and the Engineering Student and by D. C. Duncan, on Physics at the Pennsylvania State College.

Dean Hollister spoke on the growing need for a more thorough knowledge of fundamental physics, expressing the opinion that a two-year course of general physics for all engineering students with special topic courses for engineering students in the specialization years was desirable.

Professor Duncan presented data which have been collected by the Physics Department of the Pennsylvania State College, over a period of years, relating to the grades made in physics by students from the various schools of engineering. Data were also presented showing the variations in grades with the instructor. The discussions which followed these papers showed the interest which the members of the section have in these subjects.

The annual informal dinner of the section was held on Tuesday evening and was attended by some twenty teachers of physics and mathematics. The meeting adjourned after expressing the thanks

of the members to the Penn State Group for their part in making the meeting a success.

The members of the Committee who were present at this annual meeting felt that there was a need for a campaign among teachers of physics in engineering schools which would bring into the Society many more of these teachers. This is offered as a suggestion to future committees.

G. E. GRANTHAM,
Chairman

EUROPEAN JOURNALS AND THE WAR

The non-receipt by a subscriber of any European chemical or other scientific journal seriously needed as research material should be promptly reported to the American Documentation Institute.

The Cultural Relations Committee of ADI, which coöperates closely with the Cultural Relations Division of the Department of State, is working on this problem, and hopes to be able to surmount such war obstacles as interrupted transportation, embargoes and censorship, which so grievously affected the progress of research during the last war.

The principle should be established, if possible, that the materials of research having no relation to war shall continue to pass freely, regardless of the countries of origin or destination.

Reports, with full details of where subscription was placed and name and address of subscriber, volume, date and number of last issue received, should be addressed to:

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TRENDS IN ENGINEERING EDUCATION *

By DUGALD C. JACKSON

Professor Emeritus, Massachusetts Institute of Technology

The situation before me is to digest for you a chapter on trends of a report on the "Present Status and Trends of Engineering Education in the United States" which I have prepared at the request of President Compton and the E. C. P. D. Committee on Engineering Schools. Before starting on my digest, let me emphasize the value of the devoted and intelligent work of the E. C. P. D. Committee on Engineering Schools from the results of which came most of the data which I studied. We of the engineering schools owe that Committee our gratitude for their work. In giving you this digest I pass over certain trends referred to in the report but here lay before you those which seem in my opinion most desirable to present at this point.

Improved Pedagogical Methods and Research Relations

Two trends of great importance are the widely spreading recognition of the need for improved pedagogical methods with more responsibility placed on the individual students for self-education associated with more sympathetic and wisely directed supervision, encouragement and counsel from the staff, and the fuller acceptance, as a tenet, of the significance of research for the education of engineering students while in the upper years of their undergraduate careers.

There goes along with these a generally increasing recognition among competent engineers that an engineering faculty of high intellectual and professional qualities usually attracts students of high order, whether the institution is of moderate financial circumstances and moderate facilities, or is of great wealth and correspondingly great facilities. It is coming to be clearly seen by engineers that, for engineering students, to quote from the Bulletin of the Carnegie Foundation entitled The Student and His Knowledge, published this year, "The best part of education for youth is to come in contact with stirring personalities that have had great adventures with ideas. If a young mind can recognize what these ideas mean and whither they tend, it is undeniably the

* Presented at the 47th annual meeting, S. P. E. E., State College, June 19–23, 1939.

greatest possible stimulus for him to catch these meanings from a living person."

But it is well here to emphasize that for engineering students the phrase "contact with" must be understood as meaning "association with and working with, or under the intimate counsel of." Unhappily, this relation between the quality of students and the quality of the teaching staff is not always suitably recognized by administrative officers when making appointments or promotions.

The criteria applied to selecting and promoting staff appointees are in a badly mixed trend. In a few institutions, notable effort is exercised to achieve a staff which responds to the important man-qualities discussed in certain chapters of the report from which I am taking the chapter on Trends to digest for you. In other institutions, there seem to be no such guiding principles, but other and less desirable criteria seem to be controlling. Data are not sufficient to prove that the trend has been one way or the other compared with the increasing aggregate number of staff members, but they do plainly show that the trend toward outstanding influence of some engineering schools (compared with others) has been coincident with increasing repute of their teachers in engineering thought, in contributions to engineering knowledge, and in encouraging their own close intellectual relations with ambitious and competent students.

With respect to students, it has come to be recognized in some degree that "the intelligent interest which the individual brings to bear upon a given subject" outweighs in importance for students of engineering the amount of time spent in formalized class exercises. The combination of this attitude and the practice of selecting more judiciously students to be accepted by the engineering schools seems to be raising the level of student achievement wherever the two ideas are joined in use.

The effect on student achievement which may be secured by student selection, which is carefully made and carefully maintained, is favorably commented on in the Carnegie Foundation Bulletin on The Student and His Knowledge, and is ascribed to the fact that such selected minds "naturally tend to learn more than the curriculum requires; they are inclined to organize and to retain better than others what they learn." However, the existence of such trend relations may be denied by many sincere administrative officers and staff members in engineering schools, and a fuller examination of such experience as now exists in the schools is necessary to give final proof to the point.

It is obvious that some engineering schools are directing increased care to the processes of selecting students (and particularly to selecting freshmen); and along with this, there is a grow-

ing attention to improving the study practices of the students, associated with encouragement to intellectual self-reliance. Financial aid for students is now being dispensed more steadfastly and judiciously with student selection in mind, whether the funds are provided through scholarships, student loans or some other means like the plans of Stevens Institute and Yale University. Foremost quality of student achievement has gained the lead compared with quantity of mediocre achievement, and those who are often called "the superior" students receive more attention. It still apparently is difficult for faculties to take students at their individual levels and encourage them to progress at individual speeds, but some special devices like honor seminars in junior and senior years show that the difficulty referred to has begun to dissolve.

A slowly widening interest among the engineering schools in examinations of truly comprehensive (*i.e.*, of widely inclusive) character, and reduced emphasis on term examinations in individual subjects, is a trend which is now observable. Comprehensive examinations placed as qualifying examinations before promotion from the sophomore to the junior years have been discussed.

Conventional and highly predigested text books continue in use in even the most dynamic branches of engineering, but stimulating treatises are not lacking for use. The latter are receiving increasing favor in institutions where teaching loads are not overheavy.

These things seem to go in association with the distinction of a faculty for its own achievements in science, engineering practice, and pedagogy; and reputation in those respects is tending to draw selected students to certain institutions for advanced study.

The increasing interest in student meetings (by districts or at general meetings) of the national engineering societies is a trend of notable importance which now has strong momentum. It proves a valuable aid to developing in the students a feeling of responsibility for their own self-education and (once established in this manner) this sense holds not only within college but, happily, also is maintained after graduation. Prizes offered for papers presented at such student meetings and other meetings of the societies are an effective part of the same exhibition of active interest in the education of engineers which is now exhibited by the engineering societies. These meetings should afford an opportunity to emphasize the topic of engineering economy and of management regarding which topic the S. P. E. E. committees are doing such fine work.

One of the most encouraging features of the trends relating to student selection and improvement of their study processes is arising in a few strongly entrenched engineering schools within which

department border lines have been softened—which is the tendency to carry on experiments in education and research in which more than one department takes an active interest. A somewhat analogous feature lies in the offering of experimental curricula that relate to developing aspects of engineering which have not yet been sufficiently matured to prove their ultimate stability.

Social Relations and Responsibilities of Engineering Schools

A very impressive trend lies in the central feature named for this convention, which is the rather recently emphasized attention to the social relations of engineering and the social responsibilities of engineers. This trend is a very wide and fruitful affair which touches engineering education on all sides, from such monumental questions as the effect of engineering practice and invention upon private and public expenditures, on the one hand, to such administrative questions within the engineering schools as the proportion of admitted students who withdraw before graduation. One of the significant manifestations of this trend is to be observed in the interested coöperation now established between the national engineering societies, the Society for the Promotion of Engineering Education, and the numerous centers of engineering education. The Engineers' Council for Professional Development, with its four committees related to the education and professional recognition of engineers, is an outcome of this sympathetic coöperation between the societies and the instrumentalities of engineering education. The same influence of an expanding sense of social responsibility has favorably affected the coöperation between industry and the engineering schools, and between individual practicing engineers and the schools. In this, the engineering schools ought to develop a more thoughtful part, emphasizing pedagogical ideas.

This same broad question of the social responsibilities involves the present high rate of broken student careers and also involves, in an administrative way, the organization of engineering schools. The woefully large proportion who enter the engineering schools as students but who withdraw for one reason or another before reaching the goal of graduation has been commented on again and again in conferences and reports, including the report of the S. P. E. E. Board of Investigation and Coördination of 1923–29. A portion of the effort of such students is profitable to them but with many students it is a plain waste of time and money. The E. C. P. D. Committee on Student Selection and Guidance, R. L. Sackett, Chairman, hopes to discover measures for selecting the students who enter the engineering schools and also for providing some guidance for them so that the great waste may be lessened.

Into the broad field of social responsibilities for the institutions also comes the growth in popularity and in numbers of junior colleges. Their trend is forwards and upwards and many of them now include instruction in engineering subjects. The relation of such instruction to preparation for entering the engineering schools with scholastic credit is still in the stage of discussion.

Trends and Variations among the Curricula

Curricula are sources of both trends and erratic variations. A dynamic three-quarters of a century, with vigorous growth of curricula amid clamoring expressions of needs, affords neither length of time nor calmness of spirit adequate to the clear outlining of principles and objectives for the educational processes in a great field of human endeavor where the field is open for free development. The results in engineering have been astonishingly good for the circumstances, as has been shown by the S. P. E. E. report of 1923–29. There has been in engineering education a long swing of changing proportions of subjects, changes of pedagogical methods, and formulation of specific curricula. The total trend has been, and is, one of steadily expanding accomplishment. Devoted and learned men have dedicated their lives to the achievement, often under discouraging circumstances. They have stirred large numbers to discipleship. Under the circumstances, the steadiness of the principal trends regarding curricula is notable; and this steadiness persists in the face of constantly applied examination of the educational situation.

The data show that the civil engineering curricula came to their highest concentration of technical subjects about 1915, and that the tendency since then has been a slight retreat. The same may be said of the curricula in electrical engineering. The mechanical engineering curricula, however, came to their highest concentration of technical subjects somewhat later—about 1923. They have not shown the tendency to a retreat from this situation which is shown by the other curricula, and at the present time exhibit a slightly stronger emphasis on the technical subjects than the data show for civil engineering and electrical engineering. The great significance of these data, however, seems to be in the trends regarding time-allotments for arts of expression (spoken, written and graphic), humanistic and social subjects, and free electives. The data show that English has substantially held its own (in hours assigned) over several decades, graphics have fallen off, and foreign languages have substantially disappeared, leaving a balance of freed hours. Economics and sociological subjects and free electives have taken up the freed hours. Shopwork may, here and there, have given up a few hours to the same cause.

This adjustment is worthy of the closest examination for the purpose of securing more hours for political economy and restoring some to foreign modern languages. An encouraging tendency of thought is observable in this field, but it is slight as yet and does not reach the heart of the situation.

The change in attitude within the engineering schools towards instruction in English has been almost revolutionary. From a subject accepted as an item of the curriculum with only a degree of toleration, it has come to be esteemed alike by faculties and students (as well as by engineers in general) as an important feature in competent engineering curricula; but there is great need for resourceful originality applied to processes of teaching the subject. The work of this Society's Committee on English may do a great deal toward capitalizing on that situation. The conferences of this Society on English instruction are having a good influence. At the same time, the foreign modern languages have lost support in the engineering schools but an indication is appearing of some reversal of sentiment regarding the foreign languages.

The trend in mathematics and the natural sciences has been strongly toward better grasp of the subjects by students. A part of this accomplishment arises from better adapted teaching methods and another part from a better attitude toward research for students who are in the higher engineering classes.

Attitudes expressed within engineering circles toward the importance of economics and sociology (which will here be jointly called political economy) as subjects for close and accurate study by engineering students, have changed tremendously in the emphasis put on the words "importance," "close," and "accurate." But faculties have been slow in conceiving measures for accomplishing the purpose. It probably is a fact that engineering faculties now generally agree on a need to dovetail engineering into political economy in the curricula so that engineering and political economy may directly and soundly influence each other, as has been done so well with engineering and the physical sciences, but the means for accomplishing this aim have not been set up. Many attacks on special aspects of the broad relations of the two are carried on with interest and apparent success, but no vigorous attack on the fundamental core of the joint problem has been provided as yet; and nowhere have funds been made available to support adequately such a fundamental attack.

Varieties Among Curricula and Organized Options

The present tendency is for each institution to provide a considerable number of curricula, each possessing a large proportion of

material which is substantially common to all, although the teaching methods and illustrations may be different—with each curriculum emphasizing the particular applications toward which the curriculum is directed. Thereby is obtained a freedom of choice among special fields needed to satisfy the legitimately diverse tastes of students and also some freedom of choice among subjects by the provision of electives, while an integrally conceived but flexible plan is available for each student to follow. Some notably able engineering teachers preach an adverse doctrine, but the gradual increase in the number of soundly-established and respected curricula shows the force of the trend. It is, however, becoming generally accepted that such curricula should be sufficiently similar during their first two years so that students may readily transfer from one curriculum to another at the end of any term during that period.

A paramount problem which needs to be settled before the dispute over length of curricula, and the desirable extent and character of their diversity, lies in the definitions of the "fundamentals" of science and of political economy. Along with this goes the question of how much of each aspect of fundamental science and of fundamental economics and of fundamental sociology is needed in the composition of the above referred to common core in engineering curricula. Until these points can be brought within some consensus of opinion and be thoughtfully determined, one by one, the trend of thought regarding variety and length of curricula will continue to be erratic because controlled by incomplete experimental empiricism. In our present situation, difficulties caused by problems of congestion in curricula sometimes have more directive force than good pedagogical philosophy; and convenience of administration sometimes has more influence than the production of continuity of thought and endeavor for the students.

The evolutionary trends of every important branch of engineering practice result in constant demand for changes in engineering education, and the now notable tendency to establish experimental curricula or introduce newly-defined experimental subjects of instruction seems to be legitimate and likely to continue but needs careful restraint in performance. The E. C. P. D. Committee on Engineering Schools faced this situation with courageous wisdom tempered by cautious liberality.

Trends in Evening Curricula and Coöperative Courses

Out of the changes in engineering affairs, and particularly changes of industry, have come the impulses that have produced evening curricula leading to engineering degrees and also those that

have produced coöperative courses. This report relates to undergraduate curricula but it is to be remembered that these several threads of development also are appropriate for planned graduate work. It is becoming accepted that engineering schools located in centers of diversified industry owe an obligation to the citizens of the community and to the industries for making engineering education possible to all who demonstrate competency, desire, and fitting personal qualities. Out of this situation has arisen the strong trend for establishing evening curricula in certain highly industrial cities.

The earlier evening schools were relatively meagre and of thin quality, but the content of evening engineering curricula has come to equal in extent and grade the content of the day curricula in certain institutions. The arrangements for suitable engineering teachers in evening work are improving and the relations with industries whose employees pursue these evening curricula are also improving. The trend is toward full equality between the day curricula and the evening curricula in the instances of those institutions that grant like degrees for both.

The trend in firmly established coöperative courses is toward periods of interchange between college and works which are longer than Dean Schneider originally set up at the University of Cincinnati, with an approach to periods which are co-terminous with regular college terms as adopted at the Massachusetts Institute of Technology when the electrical engineering coöperative course was there established. A tendency to reduce the extent of competent academic work which had appeared in some of such curricula apparently has been turned by the effect of consultations with the E. C. P. D. Committee on Engineering Schools. The responsibility of industry for a mutual interest in the coöperative engineering courses is being more fully invoked, which adds generally to the welfare of engineering education. The depression has caused modifications of details in many instances, but the principle has survived unexpectedly well the destroying influence of the depression, and industry continues to turn favorably toward coöperation in various aspects of engineering education.

Lack of Clear Definitions for Guides

The dynamic changes which have been affecting all important engineering branches have tended to blunt the keenness of definitions of the purposes of engineering education, as far as such existed. That is, the definitions of engineering education that are to be inferred from printed and spoken statements seem to grow less exact. Here is an important task which is open for the E. C.

P. D. Committee on Engineering Schools—that is, the formulation of a broad but convincing definition of the purposes of engineering education.

A notably fruitful trend in engineering education is the already referred to increasing recognition of research as a factor in such education of which the importance should be held constantly before the undergraduate upper classmen of the engineering schools, and which should be participated in by those students because competent engineering is a research occupation. However, it is not necessary to support elaborate graduate work or great research projects for the purpose of securing a substantial influence of research on the upper classmen among the undergraduates. That is being accomplished by the effect of suitable men on the staff in some institutions in which little or no formal graduate work is provided; but the spread of this tendency is yet rather narrow among such institutions and there are no clear-cut definitions of the possibilities by which administrative officers may be guided.

It is clear that there is an increasing recognition by the public in general that a superior order of intellectual qualities is required for gaining important achievements in engineering, and that superior moral qualities are required in support of the achievements when they are gained; also, that theory must be tempered with practicality in engineering; that character stands before knowledge among engineers; and that study of technical subjects teaches character in its features of intellectual honesty and steadfastness of purpose. It is equally clear that this growing public recognition increases the responsibility of the engineering schools and their faculties to produce education of high professional calibre in association with technical competency, but in this, again, clear-cut definitions are lacking.

The lagging tendency in the development of interested participation by the teachers in professional engineering and professional educational matters (which may be an indication of their professional standing) may be illustrated by the extent of participation in professional society affairs. Taking S. P. E. E. for an example, of those who occupy full professors' chairs in the respective groups of engineering subjects usually alloted to civil engineering, mechanical engineering, and electrical engineering, from 65 to 75 per cent are members of S. P. E. E. That is from 25 to 35 per cent of the full professors teaching engineering subjects in those three great branches of engineering are not members of S. P. E. E. For the higher grades of membership in the professional engineering societies of the respective branches, the percentages on the whole are a less favorable exhibit of tendency toward professional interest by the professors.

One Unfortunate Influence of Foggy Definitions

The old-time character of institutional jealousies has been for a considerable period in course of softening and this has resulted in a trend of potentially great importance, namely, coöperation between institutions, individually and by types. Unhappily, a trend now exists which disturbs the balance in the wider aspects of education within the field of engineering. This is the tendency of Technical Institutes to change into the scope of degree-granting engineering schools. The need in the engineering field is not for fewer students in the aggregate of those who are preparing for higher engineering work plus those who are preparing for the engineering trades; but the need is for better-sifted engineering students in the engineering schools and an increased proportion of Technical Institute students looking forward to the engineering trades. The tendency referred to is in the opposite direction from the needs. Its strength is increased by the manner of administering engineer-licensing laws in several of the states, by which engineering school graduates are credited with an equivalent of practice on account of their degrees while those without degrees do not secure such credits for their studies. This trend is causing more unbalance than ever of our already unbalanced educational provisions in the technical field. No means have been proposed for off-setting this unfortunate situation. A correct trend would be to increase the number and the excellence of Technical Institutes for training competent technicians in all industrial divisions of the country.

In the foregoing I have given a factual résumé of which the basis (along with notations of many collateral trends) will all be found in the full report when it is published.

KNOWLEDGE AND WISDOM *

By DEXTER S. KIMBALL

Dean Emeritus, Cornell University

Society is always the result, to a large degree, of the experiences of preceding generations although the proportion of these experiences that become a permanent possession of the race is surprisingly small. Great civilizations arise, flourish and crumble into dust in which we dig in an effort to understand them in terms of modern life. And an observation of the wrecks of time may often give rise to the thought that it is not worth while to worry over the future. That great pessimist, Omar Khayyam, has thus expressed this thought,

> The worldy hopes men set their hearts upon
> Turns ashes or it prospers and anon
> Like snow upon the deserts dusty face
> Lighting a little hour or two—was gone.

But all human experiences are not lost; there are always some that descend from every generation to the next, their relative value depending upon circumstances. Omar again expresses this idea when he sings

> Iram indeed is gone with all his rose
> And Jamshyd's seven-ringed cup where no one knows
> But still a ruby kindles in the vine
> And many a garden by the water blows.

Now it is the high duty and responsibility of the teacher to sift the ashes of the past for such knowledge and wisdom as he may discover and to pass them on to the rising generations. His is a very great responsibility for on his teaching depends the future of the world. The church in all its branches has always recognized this fact and modern dictators are quite alert to its possibilities. And you will note that I distinguish between knowledge or learning and wisdom for I believe they are quite distinct qualities. You have all known men who were highly learned and filled with knowledge, but who were far from being wise and there have been many wise men who could not qualify as learned in a modern sense. Learning

* An address given at the annual dinner of the S. P. E. E., June 19–23, 1939, at which Secretary Bishop was the guest of honor.

or knowledge comes through reading and observation, but wisdom comes through meditation and is, apparently, a function of time.

When as a young man I joined the faculty of Cornell University, I made the acquaintance of a group of much older men who made a great impression upon me both for their knowledge and wisdom. Foremost among them was Dr. Andrew Dickson White a great scholar and a wise "counsellor" as he is described upon his monument. I have always considered it one of the blessings of my life to have been personally well acquainted with this learned and wise man. There also I made the acquaintance of Dr. Robert H. Thurston, who did so much pioneer work in engineering; Dr. Liberty Hyde Bailey, who has made a vast contribution to scientific agriculture; Dr. Jacob Gould Schurman, and many others whose knowledge and wisdom have made that institution famous. It was a "colorful" faculty and I wish time would permit me to tell you something of this interesting group of teachers. I shall digress, however, to describe one of them—Hiram Carson, Professor of English Literature. I can see him now—a tall gaunt figure with a weather-beaten countenance, long scraggly whiskers, a "stove pipe" hat upon his head, in winter two overcoats and a cape upon his body, many rings upon his fingers and a far-away look upon his face. He was a scholar and a wit with his knowledge at his finger tips. Many stories have gathered around him, many, no doubt, apocryphal, but this one at least fits his general characteristics. Three students thinking to get a "rise" out of the old gentleman approached him in single file. The first hailed him—"Good morning Father Abraham" to which the professor replied with a stately bow. The second hailed him "Good morning Father Isaac" with similar results, and the third addressed him "Good morning Father Jacob" for which also he received a polite nod of the high hat. And then the patriarch hailed them before him and in his sepulchral voice said—"I am neither Abraham, Isaac, nor Jacob, but I am Saul the son of Kish who was sent to look for his father's asses and lo, I have found them."

As I have said this group of elderly teachers made a vivid impression upon me. Perhaps they possessed some of the characteristics of the biblical patriarchs that enabled these ancients to impress themselves so vividly, not only upon their own people, but upon the entire western civilization. If Father Abraham could come and sit with us this evening we would, no doubt, find him a very wise and lovable old gentleman, but he would not be learned judged by modern standards. And so it would be also with Jacob, who you may remember went down into Egypt to visit his son, Joseph. Joseph was the first New Dealer, at least he organized the first "ever normal granary," an idea which our agricultural statesmen are now

wrestling with. He was also the first man on record to withstand the wiles of a handsome woman; or perhaps she was not so handsome, the record does not state. Anyway, he took Jacob into the royal presence and Jacob lifted up his hands and blessed Pharaoh. Now what was it that this old shepherd possessed that the greatest ruler of his day did not have? I have an idea that Pharaoh felt somewhat humble in the presence of the old shepherd though, no doubt, he himself was well informed in the learning of his day.

And then there was Solomon reported to be the wisest man that ever lived which reputation I greatly doubt. He is said to have had seven hundred wives and three hundred concubines and I submit that no wise man would gather that many women around him. He was fortunate not to live in these modern times. Imagine the problem of obtaining one thousand of these funny little modern bonnets each different from any other, though the parade to the synagogue on the Sabbath would be colorful. If Solomon could sit with us he would insist on making a few proverbs for the use of the secretary to-wit—"My son:—hearken not to the Professor and lend not thine ear to the Assistant Professor when he pleadeth poverty—make him pay his dues." I have never been able to work up much enthusiasm over Solomon. But David, if he could sit with us, would be different. David would bring his harp and he would lift up his grand old tenor voice and sing the twenty-third Psalm—"Surely, goodness and mercy shall follow me all the days of my life and I will dwell in the house of the Lord forever." And we would be tremendously lifted up and there would not be a dry eye among us.

Now these wise old gentlemen could not by any stretch of imagination be called learned. They would not know the difference between a differential equation and the law of diminishing returns, and the relative merits of knowledge and wisdom have presented an education problem for many centuries. The first great school in the background of western civilization was Plato's Academy in Athens. Plato did not try to teach physical knowledge, but rather to impart to his students those precepts that tend to make men wise morally and spiritually and his teachings are still numbered among the greatest contributions to human existence. But when the first modern universities were established at Balogna and Padua in the twelfth century the educational content was greatly expanded to include all fields of knowledge then recognized. The great Galileo himself taught Physics at Padua and the Englishman, Harvey, who was afterward to discover the circulation of the blood was for a time a student at one of these Italian institutions. When the university idea was transplanted to England at Cambridge and Oxford the concept was narrowed again and these institutions be-

came the great sponsors of the classics and humanities. There is little doubt that their teachings were well suited to England's needs and for centuries they supplied her leaders in many phases of her national life.

It was quite natural that our New England forefathers should copy these institutions and Harvard, Yale, Princeton, Kings College (now Columbia University) and William and Mary were established in the classical tradition, in some cases with sectarian flavor. It was fortunate that this was so and that the classics and humanities were firmly rooted in this new soil before the advent of the modern industrial era. A number of state universities were later on established in the older tradition as were also a large number of smaller sectarian colleges. In the latter group stress has always been laid upon moral rectitude. All of these institutions have had a profound and helpful influence upon our national life.

The first great break in this educational tradition came with the founding of Renssalaer Polytechnic Institute in 1823 followed by similar foundations such as those of the Brooklyn Polytechnic Institute in 1854 and Massachusetts Institute of Technology in 1861. These new institutions represented fairly clean-cut breaks with the old educational content and foreshadowed the need of the schools of applied science now accepted as basic features of our national life. The greatest recognition of these new ideas came, however, through the Morrill Act of 1865 which established the so-called Land-Grant Colleges. The founding act states that "without excluding classical and other subjects and including military tactics" these colleges shall teach such branches of learning as are related to agriculture and the mechanic arts in such manner as the legislatures of the several states shall prescribe. The classics and humanities are here made *permissive*. It is true that political domination has sometimes retarded the proper growth of these colleges. But where they have been intelligently and sympathetically administered, where they have taken full advantage of the permission to include the liberal elements of education and have tried to realize the vision of the old Italian "university," they probably reflect more fully than any other the needs of a modern civilization. Not only have they made a vast contribution to engineering and agriculture, but some of them have made great contributions to general knowledge and education.

I am quite aware that it is very difficult for scholars in the so-called liberal arts to accept many of the courses taught in these Land-Grant Colleges as real university work and their objections are often well taken. But it should be remembered that a most humble calling may be of greatest value to human progress and that which is a lowly *calling* today may be a learned *profession* tomorrow.

All knowledge is for use and there is none that is "common or unclean."

The organization of the Society for the Promotion of Engineering Education came naturally to fill the need of a form where the many and widely-scattered teachers of engineering could meet and exchange opinions. It is quite unique in its objects and procedure and has had a very stimulating influence. Through its publications and particularly through such reports as that of Wickenden and Hammond, it has acquired a position of leadership in engineering education. That position is now challenged by several other bodies not only as concerns the technical content of the curricula, but also as concerns the liberal aspects of engineering education. The professional engineering societies long ago began to scrutinize the work of the several colleges in admitting graduates to membership and this procedure has been steadily stiffened. Then came state licensing which under the influence of the National Council of State Boards of Engineering Examiners and bodies such as the Society of Professional Engineers seek to raise the requirements for professional practice. The latest manifestation in this movement is the Engineers' Council for Professional Development which has *graded* all engineering curricula in the country. Fortunately this work has been performed almost entirely by engineering educators but it should be remembered that this Council is in no respect a creature of this society but was organized primarily by the professional societies and the S. P. E. E. was invited to participate in the work. The writer is not at all opposed to the elevation of standards in the technical societies and for licensed engineers and believes that the engineering colleges should recognize this tendency and meet the challenge thus presented. But he would also note that the argument so frequently presented by advocates of higher standards that engineering education should be developed along the same lines as law and medicine is quite erroneous. The graduate in law expects to take his bar examinations no matter what he may do thereafter and the graduate in medicine must meet specific state requirements before he may practice. In both cases college preparation must be directed toward well defined objectives. In engineering, however, statistical experiences extending over fifty years show that only about 25 per cent of all graduates remain in work that can be classed as technical or engineering occupations. The large majority go into a wide range of business and industry for which their education forms a background. It is this majority that has made American industry what it is both as to manufacturing methods and management. There are as yet no professional standards for this field and the writer hopes no one will try to formulate such standards. The E. C. P. D. has, however, recognized certain general

features of curricula that prepare men for this broader field. Engineering education, therefore, has a much broader function than preparing men for state licensing or membership in professional societies and the colleges should see to it that the initiative as to *what* and *how* to teach is not wrested from them by enthusiastic but mistaken advocates of high professional standards.

And this remark applies with equal force to the extension of the curriculum to include more of the humanities which presumably add to our wisdom. All thoughtful educators in our field appreciate that when technical education split off from the parent stem there were left behind certain basic conceptions that all educated men require. We have been reminded constantly of this lack by educators of the old tradition and more recent developments in politics and industry have accented the needs of engineering graduates for a broader educational foundation. Much has been written and spoken concerning this problem but no real comprehensive effort has been made to define the content and scope of these broader studies that should be added. The matter still lies in vague and ill-defined outlines in our minds. The danger lies in the possibility of having the initiative taken from us by outside organizations. Last winter a bill was introduced into the legislature of New York State that would have required all applicants for an engineering license in that state to have at least two years of training in a college of liberal arts. Fortunately, the bill was killed but I have no doubt that the idea is still alive in many quarters and will surely reappear. In my opinion this society should bestir itself and develop some solution of this pressing problem in terms of content and time. If we are to go to a five year course, the reasons should be clearly defined and accepted by all colleges. It should not be left to other bodies that have special and somewhat selfish interests to tell us what we shall teach in order that our graduates shall be both learned and wise.

So much for the Society. I now wish to say a few words about our Secretary. This year marks the twenty-fifth anniversary of his service to the Society and it is fitting that it should be made a special occasion. Twenty-five years is a long time for any man to serve a society and especially a group of prima donna educators. But for that period of time our genial secretary has managed the affairs of the Society, quietly and unobtrusively and the success of the organization has been due in no small measure to his ministrations. He has built up the publications until they are an authority in their field. The annual meeting has grown in size and importance until its presence is eagerly sought by all of the universities that can accommodate its greatly increased attendance. It is a great event for any college to have the Society hold its annual meet-

ing in its precincts. His services to the Society have been of the very greatest values. He is a great secretary. I class him with the greatest secretaries of professional societies, and that is high praise.

This success has been due partly to a natural liking for the work, but more to his personal qualities. He has always been a teacher and in the university that he serves, he is held in highest regard by both faculty and students. He has, therefore, firsthand knowledge of educational problems. I have had the pleasure of his friendship for many years and can speak knowingly of his many fine human qualities. I can best express my appraisal of him in the words of Robert Louis Stevenson. In the old Spanish Plaza in San Francisco where Stevenson loitered in the sun and gossiped with sailors from the seven seas there stands the first monument erected to his memory in this country. It is a great slab of granite surmounted by a bronze galleon running free before the wind with all sail set and pennons flying gaily from the mastheads, a fitting symbol of his adventurous life. And on the slab is carved this quotation from his writings.

> To be honest, to be kind, to earn a little, to spend a little less; to make upon the whole a family the happier for his presence; to renounce when that shall be necessary and not be embittered; to keep a few friends but these without capitulation; above all on the same grim condition to keep friends with himself, here is a task for all that a man has of fortitude and delicacy.

To me these words describe our secretary quite accurately. He has done his difficult task cheerfully when matters went his way and when they did not; he has made many friends and no man can walk the earth wearing the smile that he always carries who has not made friends with himself and who does not have the inner consciousness of living a good and useful life.

Dr. Bishop, the Society is deeply conscious of the contribution that you have made to its life and growth and deeply grateful for it. And it wishes to record permanently its appreciation of your services. To this end it has had prepared an illuminated testimonial that may be a constant reminder to you and yours of our sincere affection and esteem—I shall read it.

"To Frederick Lendall Bishop, Ph.D., the Council and members of the Society for the Promotion of Engineering Education, salute and felicitate you on the completion of twenty-five years of service as our Secretary. We recommend you for the capable, faithful and unselfish performance of the duties of your office; and we are grateful for the wisdom you have brought to our councils and for your devotion to the welfare and advancement of our So-

ciety. Your long and distinguished service as Secretary, your sound and discriminating judgment as Editor, and your conspicuous achievements as scientist, engineer and teacher have contributed to the improvement of engineering education and to the enhancement of the dignity of the engineering profession. In recognition of your outstanding accomplishments and in token of our sincere affection we take particular pleasure in presenting to you this testimonial of our respect and gratitude."

And now President Compton, may I ask you to present this testimonial to Dr. Bishop. (Testimonial appears on inside back cover of the September JOURNAL OF ENGINEERING EDUCATION.)

CIVIL ENGINEERING PAGE

Notes of interest for members of the Civil Engineering Division.
—Editor, EDWARD E. BAUER, *University of Illinois, Urbana*

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SHOULD MOMENT DISTRIBUTION BE TAUGHT TO UNDERGRADUATES?*

BY STANLEY H. FILLION

Assistant Professor of Civil Engineering, Worcester Polytechnic Institute

There are apparently a number of practicing engineers and some civil engineering teachers who regard the Cross method of moment distribution as belonging in the field of advanced structures. Since it can be used for determining the moments in an exceedingly complex frame to any degree of accuracy required, it is therefore assumed to belong in the graduate courses in structures. Actually, however, investigation of the few principles involved in the method will show that such is not the case. Its inherent simplicity is one of its outstanding characteristics. One of the easiest problems to which the method of moment distribution may be applied is that of determining the unknown moments at the supports of a continuous beam. Let us consider this problem in more detail and compare the solution by moment distribution with the usual one employing the theorem of three moments. Emphasis in undergraduate courses is always placed upon the teaching of "fundamentals"; perhaps we may be able to indicate an advantage for one method over the other on this basis. Accordingly, we will first examine the arguments upon which each is predicated.

The laws governing the behavior of a continuous beam are identically those governing the simple beam. In setting up the differential equation for the curve of deflection of a loaded beam, certain assumptions have to be made. These assumptions regarding Hooke's Law, the modulus of elasticity in tension and compression, plane sections remaining plane, etc., are so well known that it is not necessary to repeat them here. On the basis of these assumptions the differential equation of the curve of deflection may be obtained.

$$\frac{d^2y}{dx^2} = \frac{M}{EI}. \qquad \text{eq. (1)}$$

This equation with its solution is fundamental to both the three-moment equation and the method of moment distribution. Integrating it twice for each of two adjacent spans of a continuous beam and making the slopes and moments equal at the common support, there results the equation of three moments,

*Presented at the Young Instructor's Program of the S. P. E. E. Civil Engineering Division at State College, Pennsylvania, June 1929.

which, for uniform loads on prismatic beams, takes the following form:

$$M_a L_1 + 2M_b(L_1 + L_2) + M_b L_2 = -\frac{w_1 L_1^3}{4} - \frac{w_2 L_2^3}{4}. \qquad \text{eq. (2)}$$

The method of moment distribution requires a knowledge of (1) fixed-end moments for various types of loadings, (2) carry-over factors, and (3) relative values of beam stiffness. Before considering continuous beams the student will have studied beams of one span which are completely restrained at both ends. Thus he will already be familiar with fixed-end moments which will have been obtained through the use of eq. (1). The carry-over factor is the ratio of the moment induced at one end of a restrained beam to a moment applied at the other end. This also may be derived from eq. (1). The stiffness of a beam is a measure of its resistance to rotation. Again, by means of eq. (1) the stiffness may be shown to be proportional to the moment of inertia divided by the length of the beam. Thus it is seen that eq. (1) is fundamental to all of these concepts just as it is fundamental to the derivation of the three-moment equation. We conclude that there is no preference to be made on this basis.

As a further basis for discussion we may ask these questions: Which of these two tools provides the best training in the education of the student? Which encourages better understanding of beam deflections and moments? Which provides more stimulus and interest for the student? In the author's opinion all of these questions are answered in favor of moment distribution. Consider the use of the three-moment equation for an actual problem. One equation must be set up for each intermediate support and the resulting equations must be solved simultaneously for the unknown moments. The solution is simple and straightforward but let us consider it in the light of the questions we have just asked. Does the process of substituting lengths and loadings into eq. (2) have any intrinsic value? Does each step have a physical meaning for the student? Does a solution of simultaneous equations stimulate his imagination? The answers are obvious. After the first equation has been set up the student is dealing with "handbook engineering."

Contrast this solution with that obtained through moment distribution. The handbook will probably be used to obtain the fixed-end moments but the student cannot feed them into a mathematical contrivance and get the answers. The fixed-end moments are placed upon a diagram of the beam. The joint most out of balance is determined by inspection, released, and the balancing and carry-over moments figured and entered on the diagram. Other joints are balanced in succession and the process continued until the student judges he has the desired accuracy. Every figure placed on the diagram in the process of solution can be visualized in terms of rotation and curvature. Judgment and engineering sense are of value in the application of this method and are stimulated. One does not have to worry about the student's interest in this part of his work in structural analysis. The author's experience with his course in statically indeterminate structures for undergraduates indicates that the study of moment distribution is the most popular part of the course.

It is manifestly unfair to compare moment distribution as a structural tool with the theorem of three moments. The latter is useful for only one type of problem whereas the former is useful for a large variety of structural analyses. The comparison is made to show that even for the solution of such a simple problem as a continuous beam, the method of moment distribution is a superior teaching instrument.

How much further shall we carry the student into the various ramifications of moment distribution? The answer to this question depends upon the

point of view. The author believes that all undergraduate work in statically indeterminate structures should be primarily designed to drive home the few principles of engineering mechanics which the student has encountered in his first course in strength of materials. It is, in reality, advanced strength of materials and should be designed to promote a better understanding of moments, shears, deflections and rotations. With this end in view, study of the effects of support settlement in continuous beams seems desirable. If the student is to make portal analyses by approximate methods, one or two solutions by moment distribution would be worthwhile. But this should be sufficient. Even if time were available for study of more complicated problems in building frames, it is doubtful if they should be included. For these problems, the method reduces to a routine. It has become a professional tool and has lost much of its educational value.

BOOK REVIEW

Public Speaking for Technical Men. S. MARION TUCKER. McGraw-Hill Book Company, Inc. New York, 1939.

This delightful book is a departure from conventional works on public speaking. It is addressed very directly to the audience the author desires to reach: adult engineers and scientists who through the circumstances of their work find that addressing an audience has become a part of their responsibilities. The author conceives his purpose as extending practical aid to this special group so that they may speak more effectively and thereby increase their influence and their usefulness.

Two features of the book stand out: (1) the author's device of speaking to his reader largely through the medium of a set of "characters" who are introduced in the opening chapter by means of a description of a convention at which they display the faults of those who appear on such programs to the acute distress of their audiences; and (2) the rich mine of practical suggestions that will make the book a valuable aid to those of us who need and wish to improve our methods of organizing and presenting material before an audience.

These qualities not only achieve the author's obvious purpose of "selling" the subject to his reader and, by avoiding the monotony of conventional didactic treatment, of keeping his interest alive, but they also accomplish the more lasting purpose of making the book permanently valuable.

A listing of a few of the chapter headings will give an idea of the scope and nature of the book:

The Story of a Day's Speaking at the Convention,
Our Principal Faults as Speakers,
Nervousness Before an Audience,
Opening the Speech,
Making Contact with the Audience: Practical Devices,
Platform Manners,
The Voice of the Speaker,
Organizing the Speech,
Making our Meaning Clear,
Speaking over the Radio,
Morrison Prepares a Speech.

H. P. HAMMOND

ENGINEERING ECONOMY PAGE

Engineering economy is that phase of engineering work in which technical plans and operations meet the critical and constructive tests of applied economics.

EDMUND D. AYRES, University of Wisconsin, *Editor*

REPLACEMENT ECONOMY FROM THE POINT OF VIEW OF AN ACCOUNTANT

Two questions arising in a replacement study are:

1. What consideration should be given to the book value of the old machine?
2. What should be done with this book value if replacement occurs?

Inasmuch as book value is an accounting figure, the accountant may be in a position to contribute toward an understanding of the subject.

The book value of a machine is the difference between the cost of the equipment and the accumulated reserve for depreciation. Book value is thus determined by a series of past accounting entries based upon:

1. The original cost of the machine.
2. The estimated life of the machine—an estimate made some years before the replacement question arises.
3. A rather arbitrarily chosen depreciation formula. The initial expenditure for the machine may or may not have been wisely incurred. The rate at which the machine wears out and grows obsolete cannot be forecasted accurately. And, the choice of a different depreciation formula (output instead of straight line, for example) can change the book value substantially after a few years. A figure which is thus subject to so many uncertain influences in its derivation can hardly be accepted as a significant determinant of present replacement policy, although for some accounting purposes book value is the best approximation obtainable. Replacement is a problem in engineering economy for which past accounting costs are simply irrelevant.

If the book value of a machine exceeds salvage value when retirement occurs, the rate of depreciation has been too low, operating expenses have been understated, and profits have been overstated. Since reopening of the profit and loss accounts for previous years is impractical, the retirement loss is best charged immediately against surplus or included with current nonoperating expenses. Annual profit figures are thus estimates subject to correction when the real depreciation expense becomes known. Good business management will build up reserves adequate to absorb these subsequent corrections without financial embarrassment.

While the book value of retired equipment is sometimes added to the cost of new equipment or called a deferred charge, such practices require listing among the company's assets an item which is not an asset. In fact, there is no difference between including among the assets a deferred loss on

equipment retired and continuing to show with inventories merchandise so out of style that it is unsaleable. Moreover, carrying forward the loss cannot insure its recovery in the future. Instead, it prevents economical replacements from being made and continued capitalization of losses may also increase costs until selling prices are put so high that customers buy substitute products or competition arises.

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HENRY C. ANDERSON, DEAN, COLLEGE OF ENGINEERING, UNIVERSITY OF MICHIGAN, DIED OCTOBER 14, 1939

Dean Anderson had been in precarious health for more than a year as a result of two heart attacks. He was appointed Dean in the College of Engineering in October, 1937. It was in the following spring that he had his first heart attack. We believed he was holding his own nicely but on Saturday afternoon, October 14, he suffered a third heart attack which proved fatal.

Dean Anderson was a graduate of the University of Kentucky, and came to the University of Michigan in 1899 as an instructor in the Department of Mechanical Engineering. Eventually he became the Head of that Department in 1917. For a great many years he was associated with Dean Mortimer E. Cooley and Professor Henry E. Riggs on appraisal work, and they established a very enviable reputation for the quality of their services. Dean Anderson has been in effect a Vice-President of the University in charge of student affairs for a number of years and his association with both faculty and students has been of the happiest. His death is a very serious loss.

ENGLISH NOTES

DEVOTED TO THE INTERESTS OF TEACHERS OF ENGLISH IN ENGINEERING SCHOOLS

J. L. VAUGHAN, *Editor*, University of Virginia

THIRTY YEARS OF TEACHING ENGLISH TO ENGINEERS *

By W. O. SYPHERD

University of Delaware

My experience in teaching English to engineering students stretches back to what may seem, to some of the members of this group, to be a remote past. I recall that in the years before the beginning of the World War such men as T. A. Rickard, H. A. Waddell, and John Lyle Harrington were in both the spoken and the written word preaching the importance of good English to the engineer. And now thirty years or less later, in days of even greater confusion in the world, we hear on all sides the same kind of comment. Engineers are still telling the world how important it is that men in their profession should be able to speak well and to write well, and now and again, not always to receptive ears, even hinting at the desirability of an engineer's knowing something about the great books of the past; teachers of English are laboring with theories and methods and materials whereby to train technically-minded youths to express themselves in words of clarity and force and ease; olympian committees are subsidized to pronounce the final judgment and let us know just where we all stand in the eyes of a self-righteous, bringing-home-the-bacon, value-demanding world. Having sat in recently on the deliberations of such a committee, and being one of these teachers who are wrestling with the problem, dodging about to avoid the sharp arrows of unsympathetic or at least unknowing critics, compromising with the devil of schedule and curriculum requirements, and having for lo, these many years, suffered from the generality, indefinite-

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ness, remoteness from specific applicability of many of these comments by industrialists and administrators, I can add a fairly lusty voice to the prevailing notes of discontent, uncertainty, and vague longing. I feel that we have reached a sort of impasse in this business of English for the Engineer. And I will try to present to you briefly the conclusions at which I have finally arrived.

For brevity's sake, I will use the terms reading, speaking, and writing in talking about the subject of English for the Engineer. I will take first Reading or Literature. Under the present set-up in engineering colleges, I think that the teaching of any required courses in literature should be abandoned. A single course in literature won't help much in forming or cultivating the reading tastes of engineering students. Yes, I know what someone may say—an inspiring teacher will make the boys like literature or will stimulate good reading or will foster an æsthetic sense. I will reply by asking one question, Where are you going to find this inspiring teacher who will be satisfied to teach literature in an atmosphere of technical study, who will be almost a lone wolf among his colleagues who are teaching subjects which the student feels are vital or at least in some way related to his professional career, who will have little or no opportunity through independent study and writing to promote his intellectual growth or to satisfy his desire to make some contribution to knowledge in his field? He will of course obtain some satisfaction in his personal relations with students, in his realization that he has stimulated thought and feeling and expression among his students in connection with their reading and study of the great books of the past and the aspiring books of the present. But such satisfactions are inadequate for a man in the profession of teaching who is alive and ambitious. The rewards in the faculty of an engineering college go to the men who are teaching engineering, who are members of a profession which looks forward to a tangible goal, which is engaged in doing the worth-while work of the world. I don't mean necessarily rewards as to salary and academic rank, but rather the rewards of a successful professional man. In a liberal arts college, the various fields are on practically the same level—literature, history, philosophy, science; in an engineering college, the English teacher, whether you like it or not, is bound not to have the same personal satisfactions or the same professional status as the engineering teacher. So, if the present four-year undergraduate curriculum is to remain, forget, I say, the Literature course. If any idealistic English teacher can be found who will be willing to live his professional life in such an atmosphere, hold him, reward him, thank God for him—but don't think that there will be many more of him to come. He is bound to be a rare bird in the

garden of theorems, valves, stresses, watt-hours, indicated steam pressures, etc.

What about speaking? Well, we are in a somewhat more favorable atmosphere now. Since the great Dale Carnegie descended on an unsuspecting business world and the radio announcers impressed their unseen gullible audience with their power of swaying men's minds with carefully prepared words, we have come to realize that a man must know how to talk if he wishes to prosper in a world in which so much business is done by word of mouth. The weakest engineering student knows that he ought to try to speak well, and the most technically minded professor, imperfect as he may be in this medium, will impress upon his students the practical advantage of proficiency in this field. So, if time could be allotted, much good might be accomplished by the English teacher in this matter of speech. But, adequate time, according to the present set-up of the engineering curriculum, cannot be allotted. And, again half-hearted, half-baked attempts are made to do a job which ought to be done but which can't be done unless the administrators act in accord with a worthy theory, and in order to devote the proper time and emphasis to speech are willing to omit, shall we suggest, a technical subject from the curriculum, and furthermore, by their own example, supported by that of their engineering colleagues, to show to both speech teacher and aspiring engineer that they mean what they say when they declare that every engineer should be able to say what he has to say in simple, clear, pleasing language.

And now as to written composition—The most distressing fact which seems to emerge from the situation in written composition is that despite the relatively strong stress that is now being exerted in engineering colleges, so many of our graduates are notably deficient in their ability to write even the simplest forms of engineering correspondence. Several years ago, I examined a consulting engineer's file of about 500 letters of application for positions. Two only of these letters, written by graduates of engineering colleges all over the country, measured up to a reasonable standard of effectiveness either in content or expression. In writing that deals with ideas, with material that demands abstract thinking, the majority of our graduates are lamentably weak. Every year, for twenty-five years or more, I have tried to teach to seniors in engineering a course that is called "technical English." These students have all gone through the mill of freshman composition; they have presumably done some writing in connection with their other courses of study during the sophomore and junior years. By the close of the senior year, they have succeeded pretty well in papers which deal with facts, such, for in-

stance, as reports on laboratory experiments, periodic reports, explanations of processes, etc.; but they are often entirely at sea when they are called upon to discuss ideas.

You are all familiar with the attempts that are made in most of our institutions to remedy the weaknesses of these students in writing—the conventional Freshman English course in the study of texts accompanied by practice in writing under criticism; special plans for arousing the interest of the students in the subject; remedial courses for particularly ill-prepared and weakly-endowed students. The task for the engineering college seems almost unsurmountable. A vast horde of poorly prepared students coming up annually from the schools; an atmosphere of concentration on technical studies almost from the outset of the college course; an appalling lack of writing in connection with their technical courses; the absence of whole-hearted coöperation on the part of administration and engineering professors with the teachers of English, including the holding-up of high standards of expression for both teachers and students; time and energy pressure on the student in a crowded curriculum—these are the conditions which confront us and which cause us so often to despair of the result.

The conditions which I have so imperfectly painted do indeed appear very dark to at least one deeply concerned sympathetic observer. And I may say that I see little hope for any marked improvement unless some radical upheaval should come to pass. Were our engineering colleges to be placed on the same high professional level as our great schools of medicine and law have attained and as our schools of business and education are aspiring to attain, the problem would largely disappear. Can you imagine a course in composition or literature in one of our schools of medicine or law? In an undergraduate school of engineering, the problem of the inefficient in English, like the poor in the gospel, will always be with us.

The distresses of the poor may be somewhat alleviated; and so, may we hope, may the burden of our own problem. But not—I speak from strong conviction—without radical changes in our attitude, our policy, our curricular set-up.

I wish now to summarize and conclude as follows:

1. Much good might be accomplished if our colleges would refuse to accept high-school graduates unless they could demonstrate their ability to think intelligently and write and speak clearly. The college cannot do for the student in one year or in two years what the schools have failed to do in twelve years.

2. Assuming that the engineering schools are going to insist upon proficiency in speech and writing and upon some acquaint-

ance with the heritage of our literature, then we are bound to make some sacrifices in other fields. Some attempt must be made to create an atmosphere in which English studies may flourish. Our curriculum- and schedule-makers must realize that if anything worth while is to be accomplished, both time and favoring conditions must be provided for. These students can't read and write and speak and confer and think and digest in a forty- or a fifty-hour week that is devoted largely to technical studies.

3. As far as writing alone is concerned, the ideal situation in an ideal engineering college would be to have all writing done in connection with subject matter courses. The engineering professor would be the teacher; the English teacher might be the consultant or adviser. English would then be not a thing apart but a part of the basic studies of a student's curriculum.

It is always a question as to how much of a student's instruction in composition might most profitably be carried on in a separate course in English. In the elementary stages, formal instruction, I believe to be highly desirable; in the more advanced stages, if the "technical" teacher is competent, the English teacher may —God be praised—be done away with.

4. If any notable progress is to be made in the province of speech, adequate provision must be made not only for the time and energy which the student may devote to it but also for a teaching staff which would devote itself exclusively to the task. A great amount of time on the part of both student and teacher is involved. Here again, the administration must pay.

5. The problem of securing proper teachers for a proper English curriculum in an engineering college—again assuming that speech, writing, and reading are to be taught and also that our present four-year course of study is the norm—is, I believe, the one great administrative problem. A first-class technical student would be a good man to teach composition and speech if he were so equipped and so disposed. But he is too strongly attracted by the interests and the material rewards of the engineering profession to permit him for a moment to think of the possibilities of a career in the English field. A first-class English student is too deeply concerned with the problems, the spiritual rewards, the allurements of the English field, in which among books and serious students and fellow workers he finds congenial companions, to justify his confining himself within the restricted bounds of an English-for-Engineers life profession. The opportunities are too scanty; the rewards too uninviting; the results too soul unsatisfying.

What are we going to do about it all? I wish that I knew. We may work ourselves out of the present confusion. If so, I am confident, it will only be as the result of a radical change in state of mind, in policy, in standards, and in curricular program.

THE PROBLEM OF THE POORLY PREPARED STUDENT

By A. M. FOUNTAIN

North Carolina State College

I. The Disease

We hear from many sources that all is not well with the English training now given in the high schools. From students, from high school administrators, and especially from college English teachers, come vociferous or even profane pronouncements about its inadequacy.

Because of this deficiency of entering students, many colleges find it necessary to make special provision for sub-college study in English. The writer has made an extensive study of the problem among the colleges and universities which are institutional members of the Society for the Promotion of Engineering Education. This paper presents his findings.

II. Remedy: No Official Treatment

From more than one hundred colleges investigated, only seventeen have no established method of meeting the problem. Yet, virtually every one of them has some kind of unofficial system of check-up and improvement in standards for poor students.

Clemson and Case are typical, in that they have tried many schemes of extra instruction for poor students, but gave them up for difficulties of schedule and morale. Case will add an extra hour without credit next year. Illinois, Kansas State, Wyoming, Missouri, and Texas Tech have had experiences similar to those of Clemson.

Tennessee gives a comprehensive test in English at the first of the junior year. Students with low grades on the test must do additional work.

New Hampshire begins next year a system in which students do not receive credit for English courses until time for graduation, and then only if they have maintained a good quality of work.

Delaware and Rice give word-drills for poor students. Newark and Norwich use extensive correction charts. Florida prevents entry of poorly prepared students. Detroit puts them into the general college.

Iowa, Iowa State, Arkansas, Armour, Missouri Mines, all section students according to ability, with high mortality in the lower sections.

Tufts and New Mexico A. &. M. use many personal conferences

with poorer students. Rensselaer and Union lay the burden on the student to improve his own work.

Institutions drawing mainly on urban centers, or endowed institutions privileged to restrict enrollments have fewer poorly prepared students than do others.

III. Remedy: Extra Work Without Extra Credit

Duke, Maine, and Louisville require extra work, concurrent with regular courses, for poorer students; they are able to use upper-class or graduate English majors for tutoring. Princeton and California Tech use similar systems.

Syracuse, Yale, and Akron require extra drill sections or conferences for poor students.

Cornell and Stanford use "voluntary" coaching sections, but bring moral pressure for attendance. Stanford charges a fee.

Many institutions have systems of giving only part credit for the work taken, for example three hours of work with one hour of credit, or five hours of work with three hours of credit. Usual effect of such work is to cause the student to do an extra term in English.

IV. Remedy: Non-Credit, Sub-Freshman Courses

Many institutions give straight non-credit sub-freshman English to those students incapable of doing regular work. Among such institutions are fifteen state universities and seven state technical schools. At least six privately endowed and city-supported institutions do likewise. Average number of students required to do the work is about 20 per cent. Colleges in urban centers and colleges with restricted enrollment have smaller percentages.

Fully ninety per cent of the colleges studied find it necessary to make some provision for the inadequately prepared student.

V. Partial Diagnoses

Universalizing of high-school education brings it down to the level of the average rather than to that of the superior student. A lower class of parents demand "practical" courses, to the exclusion of more fundamental courses in English, mathematics, and the languages. The gap between high school and college seems to widen instead of to grow narrower.

State departments of education have little direct control over the type of instruction given in the high schools. The schools make little differentiation between students who expect to enter college and those who do not. Teachers are usually overloaded so much that they have no time to assign written work and then mark it for correction by the students.

College English teachers feel that high school students read too much and write too little, and that they are not taught the methods or necessity of detailed study. Many college teachers here comment, often-times bitterly, about the poor students they receive from the high schools, and frequently condemn modern teaching methods for the failure of high-school students to maintain proper standards in English.

COÖPERATION BETWEEN TEACHERS OF HIGH SCHOOL AND OF COLLEGE ENGLISH

By T. J. GATES

Pennsylvania State College

In a letter which I received not too long ago, Mr. John C. Caton, Director of the Chrysler Institute of Engineering of Detroit, explained the care with which he and his associates select appointees from the outstanding graduates of the outstanding engineering schools in the United States, Canada, and Europe. All such candidates must take two examinations—one in mathematics and one in English. Of the five thousand and more who have taken the examination in English, less than two per cent received grades of 75 per cent or better; and he adds that the vast majority of that two per cent received their high-school training in Canadian schools. I speak of this apparent deficiency in the United States high school only because that same deficiency seems to be perpetuated in the colleges and in their graduates. For it is evident that the Chrysler Institute was and is examining not the raw product of the high schools but the distinguished graduates of distinguished engineering schools. I take it as being obvious, then, that when we college teachers throw mud at our high-school colleagues, some of the mud must cling to our own hands.

But the problem of the poorly prepared freshman we certainly have. And no matter how much we may care to apologize for our high-school colleagues, no matter on what ground we try to condone their inefficiency, the inescapable fact remains that they have passed and have thereby approved persons who cannot read, whose penmanship is illegible, whose pronunciation and enunciation are beyond recording; who make all manner of childish mistakes in spelling, grammar, and diction; who cannot see relationships among facts and ideas, and who cannot organize them for intelligent and intelligible presentation to others. It is too much to expect us to accept persons who know not anything as duly accredited college students. Patience and tolerance, under such conditions, are no

longer a virtue, but rather a genuine menace to the student himself; if he is not brought up short sometime, he will have a justifiable right to believe that his language practices are worthy of approval, simply because those in authority have always approved.

Let us therefore throw mud, if need be, but let us stop doing it only among ourselves. Let us acknowledge and publicize the fact that high-school certification means nothing in itself in the great beyond high school. Let us say frankly to the schools from which we draw our students: "We will accept your graduates, the best of them at any rate. If you don't do your job as *we* think you ought to do it, that is your privilege; but what you don't do, we will do, and your graduates will have to pay dearly in money, and time, and tears." Now, that is tantamount to denying admission to some of their students; furthermore, it is making a five-year curriculum compulsory to many. When fathers and mothers hear about the probable fifth year for their son, I think they will speak not too kindly to the high-school principal. The economic pinch almost always reaches a vital spot. Furthermore, school boards may become conscious of the essential economy of providing enough teachers, and well-trained teachers, to do a thorough job. Everyone here knows that the swing has been far away from college domination, probably too far, but I think the swing is now definitely in the direction of college and high-school coöperation. A little encouragement, and a little plain dealing, may be all that is needed.

That is my first point. Let's be honest with the schools, lay the cards on the table, and say exactly what we mean.

The next point grows out of the first—close and constant communication between the college department of English and the schools from which we draw our own freshmen. The yearly report from the college registrar is not enough. True, it gives the facts of success or failure. But it contains all grades for all students. No one separates the English grades and brings them all together to be carefully examined. Even so, they cannot be evaluated because they are final grades, nothing else. The English teacher never sees them. They are filed in the principal's office "for future reference." On the other hand, a letter from the college English department is about English. It is a communication on one subject only. It brings a reply, an inquiry, a protest, a compliment.

Let me outline my own practice. After the placement tests are given in the fall, and after the percentile rankings have been determined, I send a form letter to each principal who sent us students whose standing in the placement tests were in the upper one-quarter of the class. I say nothing about the mediocre or poor students. The letter is purely congratulatory—nothing else. I get thank-you notes. The principal and teachers feel good, The local newspaper

gets copy. The principal, teacher, students, and this college get kindly publicity. Everything is lovely. Sometimes the principal inquires about the standing of some other student not mentioned in my letter to him. Then and only then do I send him bad news—in the fall. I wait, wait until spring when all the records are in. Then I write another letter and enclose the records of all of his students who are enrolled as freshmen in this college. I get more inquiries. I answer them. It takes time. But I hope you see what I am driving toward, and that the time is well invested. I am constantly telling some high schools that their instruction has failed for this or that boy. When the inquiries justify it, I try to tell how to improve it, where the emphasis should be placed, what we particularly want students to know. This spring I am adding to my service to the schools. I don't know how well it will be received, but I am enclosing a small and separate sheet telling why each poor student received an unsatisfactory grade. In that way, I hope to inform those schools who never inquire.

The results show no upheaval in high-school teaching, nor should they. But the increase in inquiries from none to as many as I can care for, and that increase in three years, is, I believe, an achievement procurable in no other way.

While I am on the subject of our departmental practices here, let me revert to my first point—that of notifying all concerned about what we intend to do about poorly prepared students. I tell the principals that such students will not be allowed to schedule college English, that they will have to pass a sub-freshman course without college credit. When I wrote that to the principal of one high school, I received an inquiry, an argument, and a protest all in one. "How did I know," the writer asked, "that twenty-five per cent of next year's class would be unprepared for college?" I didn't know that; I could only point out that previous records show that we could expect seventy-seven per cent to eighty-four per cent of the low-ranking freshmen to receive unsatisfactory grades, and that we could expect only one and six-tenths per cent to receive superior grades.

The prospective freshmen are also notified, and through them, their parents. A statement explaining the system appears in the Freshman Week Bulletin. No one is left in the dark; no one is deceived. Everyone knows what we want, and what we intend to do about it. There is little misunderstanding, and even less rancor. Fair dealing, especially if it is open dealing, produces coöperation and good will.

One further point, and the most important and most difficult of all. Nothing in the way of machinery will produce sound results without a high quality of instruction in the college itself. To

provide that kind of instruction is our fundamental task. Without it, there can never be good relations between the high school and the college. Each will accuse the other. If our demands are high and known, and if our own performance in the classroom is worthy, the high schools must and will conform, at least for those students whom they recommend to us as good college risks. If we accept others whom the principal cannot recommend, then we have no just complaint. Until we set our own house in order and until we show more signs of mutual coöperation with the high schools, we must say to ourselves something in the manner of King Lear—Give me an ounce of civit, good apothecary, to sweeten mine own imagination and mine own folly.

WHERE DO LANGUAGE HABITS RESIDE?

By ALFRED WESTFALL

Colorado State College

I am limiting myself to the problem of correctness in language habits, which is chiefly a matter of conforming to accepted practices. My problem involves pronunciation, spelling, grammar, and much else besides. Without denying the authority of the frequently repeated statement that the course in composition should teach the student to say something original and interesting rather than to spell and punctuate correctly some jejune statements, I should like to say that correctness is also important and claims a lot of time and attention. As English instructors, we should all like to turn out students who can analyze a subject into its parts, present them logically and in an interesting style. At the same time we have to correct those who say "you was," who use plurals for possessives, and who double the "s" and single the "p" in "disappointment."

We have not yet developed an adequate teaching technique to deal with this problem of correctness. A nation wide survey of a few years ago disclosed that "I seen," "he come," and "I done it," are among the most common grammatical errors of college students, even of college graduates. According to actual records, the words most frequently misspelled by college students are "too," "its," "lose," "received," "occurred," "until," "separate," "definite," "occasion," and "disappeared." All of these errors in grammar and spelling are elementary ones which teachers began correcting in the grade school, and have struggled with through high school. They are also the ones which persist after the student has finished his required course in English composition. In the meantime he has learned the simple arithmetical processes which he took

up about the same place in his educational program. He is not in doubt about the sum of seven and eight, the product of six times nine, the number of times twelve will go into a hundred, or how much is left after he subtracts thirty-seven from fifty-one. Why have the efforts of numerous teachers had so little effect on his language habits that he really does not know the difference between "i-t-s," and "i-t apostrophe s?" Our teaching methods are at fault.

While I do not pretend to communicate the final gospel on this problem, I do believe that we can find at least a part of the truth we seek through an examination of language habits. It is just as easy to say "I saw" as "I seen." No one reverses the order of the vowels in "received" because it is easier to write them in one order than in another. It is not a matter of effort. In many cases the incorrect habits actually require more expenditure of energy than do the correct ones, as in the expression "I don't hardly ever see you no more." The student does not persist in his errors through an unwillingness to use the correct form. It is only a matter of habit. This paper attempts to point out where language habits reside in an effort to discover how correct ones may be substituted for incorrect ones.

Compare, if you will, the way you write some very common word, with the way you write one concerning the spelling of which you are uncertain. When you write "and," for example, you do not think and write "a," "n," and "d" separately. The writing of such common words has become one complete process. A series of movements is initiated and the whole word follows. On the other hand, suppose that you have suddenly discovered that you have been misspelling "signature." If you are still uncertain about it, you will spell out the individual letters, hesitate over the one which follows "n," trying to decide whether it is an "a" or an "i." You may try to reason about it. You may even sound the word and try to spell it phonetically, although you are very likely to be wrong if you do. When we start to make a remark, we ordinarily do not think of the individual words we are going to use, their order and agreement. We have in mind the general idea we wish to express, we fix our mind's eye on the end of the sentence, and trust some brain center below the level of consciousness to provide the means of getting there. When these centers fail, when we get "stuck" in the middle of a sentence, we consciously feel our way along the pathway of meaning, slowly and carefully selecting and weighing words. But our communication would be less spontaneous and more painful if we always had to do that.

Psychologists speak of what they call the law of the economy of attention, the tendency of attention and the higher faculties of conscious reasoning to make responses automatic, to hand them

over to the so-called lower brain centers, and to release attention from petty details that it may be devoted to the judgments we are constantly called upon to make. Watch a child learning to write. Writing is a slow, laborious process for him. Compare his struggles with the ease with which one who has learned the art carries his pen across the page, forming the individual letters, often the words and sentences without much conscious effort.

Knowledge finds its final expression in some motor response. We acquire information in order to use it in some specific action. The knowledge and skill of the doctor would be of little value if it did not find expression in relieving the ills of some patient. There would be no economy in the engineer working semester after semester on mathematics unless he ultimately expressed the knowledge acquired in plotting curves and computing stresses and strains. The same is true of a knowledge of language. It must be used to communicate ideas. The final test of our knowledge of English is in the language habits which manifest themselves in our speech, our writing, and our reading.

Psychologists refer to these habits as behavior patterns. They speak of synapses, neural pathways, inherited and conditioned reflexes. Four factors influence the acquisition and functioning of these habits. They are the frequency of the response, the recency of its acquisition, the original intensity of the experience during which it was acquired, and the frequency with which it is recalled or used. Not much needs to be said about these factors. The student may say "he come" so many times outside the classroom that the few corrections made by the instructor fail to break the habit. You have all seen students who have had some incorrect language habit corrected, and have followed the new response for a time because of its recency, but who soon revert to their old habits. Not long ago I had a student who mispronounced and misspelled "athletic." In the first paper he handed in after I had called his attention to his mistake, the word appeared correctly spelled a time or two in the first paragraphs; but by the time he got to the end of the paper, he was back to his old spelling habit. The recency of the new habit had failed to hold its own against the frequency of the older one. After a new response is started, it must be kept alive by use or it may disappear. The frequency of recall conditions the power of a response.

The use of a personal example to illustrate the effect of the vividness of the original experience in forming a language habit is amply justified by its effectiveness. As a young instructor I attended a meeting of the National Council of Teachers of English. A group of us ate dinner together. I was much impressed with the man across the table from me, an instructor from a large university who boasted

a doctor's degree from Harvard. I am a graduate of a small institution and was teaching in a comparatively unknown college. I was thrown off my guard by the rapidity and pleasantness of the conversation. The Harvard man and I discovered that we had a mutual acquaintance, also a Harvard graduate. Unfortunately I said of him, "He plays tennis and golf, but he says that he likes tennis the best." The man across the table replied, "He surely didn't say that. After all he is a Harvard graduate." The withering remark sent the color to my face. I have long since pardoned the man who corrected me with such severity, but the vividness of that embarrassing experience made such an impression on me that I have never since had any tendency to use "best" for "better."

These principles can be successfully applied in correcting the language habits of our students. If we recognize how deeply embedded some of them are and how unconsciously they are used, we can devise a technique which will strike at the root of the incorrect habit and attempt to substitute for it a correct one established in such a manner that it has some chance to survive in those subconscious centers in which language habits reside.

Three simple steps are required in making this substitution in habits. First, the student must have his attention called to his mistake. He must know what expressions are wrong. He must be told that the word is "athletic, "not "ath-they-letic"; that "I seen," "he come," and the rest of such verb errors are wrong; that there are two "its," pronounced the same, but spelled differently; that "y-o-u-r" cannot be used for the contraction "y-o-u ' r-e"; that there is no such word as "pret," as heard in the expression "pret near," frequently used for the awkward "pretty nearly"; that the participle without a noun which it may logically modify is usually incorrect, as in the following sentence which recently appeared in *The Saturday Evening Post:* "Looking out the window, the fog could be seen rolling in from the bay."

Second, he should learn why the incorrect expression is wrong. Sometimes he must be told. It will make much more of an impression on him if he can be placed in a position where he must discover it for himself. He may be sent to the dictionary to discover the pronunciation of the word he has been calling "ath-they-let-tic." He should be made to sound the syllables in his own spelling of the word until he can distinguish between what he pronounces and what the dictionary gives as the correct pronunciation. He should learn to conjugate the verb. After he learns how verbs are formed, he can begin to understand why "I seen" is not correct, why "he don't" is impossible; and why he may have "he comes," but never "he come." There is very little evidence that the teaching of formal grammar functions in the forming of language habits, but certainly the student

who does not know how to conjugate an English verb is never going to be in a place to test and correct his own language habits. Until he learns that a participle is a verbal adjective which must modify a noun, and that all participles do not end in "i-n-g"—some college composition texts to the contrary—the student will have trouble using the participle. He has been told not to use dangling participles, but he does not know what a participle is, much less one which dangles. It does not take very long to give him an assignment which will require him to learn the function, form, and use of the participle. I have found from experience that I can teach these things to a student in less than fifteen minutes; but unless I devote that fifteen minutes to doing it, the student will not learn to use the participles, and will continue to misuse them. While I begrudge the many periods of fifteen minutes which I have put in teaching individual students the participles, I find that in the end it takes no more time than it does to continue to correct their dangling participles for a semester.

The third step, which is the most important and the one most frequently neglected, is to plant the correct habit so that it functions subconsciously. I recently brought a slow class to the place where members could all spell "separate" correctly in a spelling test, although they continued to misspell it in their papers. If I demanded the correct spelling, each one could give it; but this knowledge did not function when he was writing. It had not yet reached the place where spelling habits reside. But after I had dictated some sentences employing "separate," and had required each student who had misspelled the word to write at least twenty-five sentences using it, the error disappeared. In the first case the student had the knowledge in his consciousness, as evidenced by his ability to spell the word in the test, but that knowledge did not influence his behavior when he was writing a theme or a letter. It was knowledge he could use in a spelling test, but of course he does not take many spelling tests after he leaves the course in English composition, although he does have to spell words as he writes. In the second case there was an effort to fit the new spelling pattern into his subconscious language habits so that his accustomed motor responses would not betray him into an unintentional error while his attention was fixed on the meaning he was trying to express.

No process is truly educational until it influences action and conditions behavior. By taking advantage of the influence of frequency, recency, original intensity, and frequency of recall, we can do much to plant a correct habit where it will function more or less automatically. Until it is deeply planted, our work as instructors is not complete. One method is to get together two or three students who use "I seen," "he come," and other expressions of their ilk,

and make them engage in a rapid fire conversation of questions and answers in which they must use the correct verb forms. One asks, "What did you do last night?" The response is, "I saw a picture." "When did you get home?" "I came in before eleven o'clock." The student has to say and write "I saw" and "I came" in real situations until they sound familiar to his ear, look familiar to his eye, and slip off his tongue and his pen as naturally and as subconsciously as do the incorrect expressions.

To the student who says "I done it," I give the name Banquo, of whose ghost Macbeth said, "Thou canst not say I did it." When I meet him, I say, "Hello, Banquo. How is the ghost business? Did you get your haunting done last night?" He replies, "I did. I did some good haunting. I also did my math problems. In fact I have done pretty well this week. I am doing better all the time." With one student who persisted in saying "between you and I," I made an agreement that every time we met, he was to use the correct expression. Sometimes he would call across the street, "Hey, prof., between you and me it looks like a fine day." As an upperclassman he whispered in my ear at a dance, "Between you and me this music isn't very hot."

The student who misspells "amateur" is asked to look up the word in his dictionary to discover whether the vowels occur in the order in which they do in the alphabet. If a student misspells "villain," he is required to discover whether or not a villain ever had any connection with one who lived in a villa.

Many students have trouble with the use of the comma. Let us take one specific rule, the use of a comma after an introductory adverbial clause. I dictate sentences beginning with "when," "if," "although," "while," "even," and other adverbs, while the student writes them with a comma in the proper place, until the habit becomes more or less automatic.

There is no particular merit in the examples I have given. There are many other methods which may be used. Each instructor can devise his own. The essential idea is to set up situations similar to those the student will normally meet, and to drill him in these situations until he makes the correct response automatically. By the time the student gets into college, he has ceased to multiply when he is asked the product of nine times seven. His response is quicker and surer. Should not many of the troublesome responses in language, spelling, and punctuation also be made automatic by sinking them deep into the subconscious centers where language habits reside?

EXPERIMENTS IN TEACHING LITERATURE IN ENGINEERING SCHOOLS

By J. L. VAUGHAN
University of Virginia

In this paper the writer proposes to report on some of the experiments in the teaching of literature which are now being conducted by professors of English in several engineering schools. In addition, he will outline briefly the methods used by several instructors to add vitality and interest to their courses in literature.

At the University of Washington, Professor Amy V. Hall has organized a reading course in which she attempts to introduce engineering students to the broad fields of human knowledge. Believing that students in a technical school have little opportunity to become acquainted with the humanities, Professor Hall has prepared a list of books that will arouse the reader's interest in the world around him. The following titles will indicate the type of book she uses in her course at the University of Washington: Science: Hotchkiss—"The Story of a Billion Years"; Jeans—"The Universe Around Us"; Bradley—"Parade of the Living"; Newman—"Evolution Yesterday and Today'; Bingham—"Psychology Today"; Magoun—"Problems in Human Engineering." Sociology: Lasky—"Democracy in Crisis"; Russel—"Why Men Fight"; Dickinson—"A Modern Symposium"; Powys—"The Meaning of Culture." Art: Craven—"Men of Art." Literature: Merejkowski—"Romance of Leonardo da Vinci"; Waln—"The House of Exile"; Buck—"The Good Earth"; Lewis—"Babbitt." Religion: Browne—"This Believing World"; Van Dusen—"The Plain Man Seeks for God." (Each student purchases two of these books unless one costs more than two dollars.)

Believing that once a boy has started reading he will never stop, Professor Clyde W. Park of the University of Cincinnati has organized a course in which a student may do special reading in any field which interests him. With the assistance of the English staff, the student prepares a bibliography. When the list has the approval of the English group, he begins his course of reading. There are periodic conferences and discussions. Upon completion of his work, the student submits a report. If this is acceptable, he receives elective credit for his reading in the special field.

At the University of Virginia, the writer has an elective reading course for seniors and graduate students. This particular course was put in the curriculum at the suggestion of recent graduates; they felt that engineering students should have a broader background than the usual technical course affords. At the first

meeting of the class the instructor attempts to discover how intelligently and how fast each member of the group can read. After doing this, he uses what information he has been able to gather to make the work fit the needs of the students. The class meets for three hours once a week. At each meeting, one of the students leads a discussion on the book under consideration. Some of the books from which selections were read last year are as follows: Adams, Henry—"Autobiography"; Van Loon—"The Arts"; Flexner—"American, German, and English Universities"; Spengler—"The Decline of the West"; Marx—"Capital"; Smith—"The Wealth of Nations"; Plato—"Dialogues."

Each student who elects the course promises to read a list of fifty books at some convenient time after graduation. To date, no student has failed to complete the work he promised to do. In fact, several of the first group who took the course have requested additional reading lists. This system of post graduate reading assignments has the advantage of helping the young engineer obtain a rather broad background in literature and of assisting him in forming good reading habits at a crucial period in his career.

At the California Institute of Technology, Professor C. K. Judy has inaugurated a course known as "Summer Reading." Recognizing that the engineering student has a heavy load in winter, Professor Judy offers elective credit to anyone who wants to do reading during the summer vacation. The student is given a carefully prepared list of books. When he returns in the fall, he submits reports on the summer's work. If he has done his reading intelligently, the student is granted elective credit.

By offering a course in "Summer Reading," Professor Judy hopes to encourage technical students to read more widely and less hastily. Every English instructor who has attempted to give a literature course in the limited time available in the winter session will appreciate the advantages of Professor Judy's plan. He also reports that alumni are requesting lists that they may continue to read systematically.

In the preceding section the writer has outlined a few of the experiments now being conducted in English departments in engineering schools. In the section that follows, he will comment briefly on some methods used by teachers of English to add vitality and interest to their literature courses.

At the Polytechnic Institute of Brooklyn, Professor S. M. Tucker has aroused considerable interest in the drama by providing an excellent library of modern plays and by discussing plays that are running in New York. Oftentimes Professor Tucker will analyze a play which is being given in New York and then encourage the members of the class to attend a performance of the play that

they may criticize it for themselves. This is an excellent example of how one English staff is using materials close at hand to encourage technical students to broaden their interests because modern plays deal with psychology, history, sociology, and other subjects that are provocative.

Professor Walter Hendricks at the Armour Institute of Technology thinks that students should visit famous places and meet celebrated people. On one occasion, he arranged for his class to meet at Hull House to hear a nephew of Jane Addams discuss her work. It is Professor Hendricks' belief that students remember vivid experiences and pleasant moments spent with great people. Hence he makes his English course vital by seeing that his students get opportunities that will supplement their work in textbooks.

In May, 1939, the *Purdue Engineer*, a student publication, carried a list of books under the title "Recommended Reading." The prefatory note speaks eloquently, if indirectly, of the work being done by the faculty group and interested students at the University. The note reads: "Students with limited reading time at Purdue want to know what books of literary value there are which are interesting and readable. This list of suggestions is intended to assist them and to provide a guide for summer reading. Some of the books recommended by W. Somerset Maugham head the list.

W. E. Howland, Associate Professor of Civil Engineering.
H. L. Creek, Professor of English, Head of Department.
W. M. Hepburn, Reference Librarian.
J. L. Catlett, Professor of Modern Languages, Head of Department.
G. M. Hawkins, Associate Professor of Mechanical Engineering.
J. P. Taylor, Editor-in-Chief, the *Purdue Engineer*."

Perhaps some of the interest at Purdue is the result of the enthusiastic efforts of President E. C. Elliott, who has inspired many students by his talks on reading. On one occasion, he discussed a small collection of his favorite books under the title "Five Pounds of Books." Since the time of that talk, many students have stopped by his office to suggest new titles that they think he will enjoy.

In passing, the writer should mention that Purdue is one of the institutions where a prize is offered for the senior who has collected the best library during his years in college. This may stimulate interest in literature.

Several years ago at the Virginia Polytechnic Institute, Professor C. F. De La Barre and a staff of N. Y. A. assistants compiled a list of books recommended by various students and faculty members. He asked each person making a recommendation to

give reasons for suggesting the book. The salty comments make entertaining reading and certainly stimulate students to investigate some of the titles. It is always interesting to students to learn what books the faculty enjoys.

At Iowa State, the English faculty has arranged to have special shelves of books that appeal to particular groups of students. During the early spring, there is a shelf containing books on "How to Apply for a Job" and "The Technical Man Sells His Services." At other times there are other special shelves on many different subjects of interest to the student body.

In many institutions there are browsing rooms and recreational quarters where students may read or may listen to good music or do other things that will relieve the pressure, and sometimes the monotony, of technical studies. Many librarians have done yeoman service in an attempt to encourage technical students to read more widely. In fact, the success of many of these efforts to entice students to read are dependent upon the skill and good judgment of the library staff. For instance, a student must be stolid indeed who does not respond to an attractive display of books in a comfortable room where an open fire is blazing.

The students have organized an "Engineers' Reading Club" at the University of Virginia. During the five years in which it has been in existence, the "Club" has bought or borrowed over 500 books. It is not unusual to find that members of the "Club," or circulating library as it should be called, have sent copies of their books all over the country. This "Club," which is in no way controlled by the faculty, has done more to introduce engineering students to good literature than all the fasting, or prayer, or lecturing by the English staff. Perhaps a group like this, which has all its motivation from within the student body, will do the most effective teaching of literature. Perhaps the answer is to give the students their head and advise rather than lecture.

It would seem from the material presented above that some instructors are attempting to solve the problem of teaching literature by organizing reading courses, both during the regular session and during the summer. Moreover it is evident that many professors are using materials close at hand to make their courses more effective. Finally, there is some indication that an indirect method of acquainting students with good books is at least partially successful in arousing interest in literature.

MECHANICAL ENGINEERING PAGE

R. L. SWEIGERT,

Georgia School of Technology, *Editor*

Those who personally dominate are heroes for the hour; those who build men are immortals.

This issue of the JOURNAL introduces an addition to the activities of the Mechanical Engineering Division. Mechanical Engineering Division Notes will be published monthly. These notes will make it possible to have a national distribution of worthwhile educational philosophy, psychology, and practice as applied to the education of professional mechanical engineers.

These notes will become the most effective if the members of the Division will contribute any new developments in mechanical engineering education that may take place in their respective institutions. The officers of the Division alone cannot create the best set of notes each month. *The success of these notes depends upon each member of the Division.* Let us make them a permanent record of the national development of mechanical engineering education.

For the benefit of those members who have not been able to attend national meetings recently, the organization and activities of the Division will be presented. These can be presented best by giving the by-laws passed at the Cambridge meeting with the revisions passed at the meeting at Texas A. and M. College. The by-laws follow.

1. The Division of Mechanical Engineering of the Society for the Promotion of Engineering Education is organized to provide opportunity for a consideration of the many problems incidental to, and peculiar to the teaching of Mechanical Engineering subjects in Engineering colleges.

2. The membership of the Mechanical Engineering Division shall consist of those members of the Society for the Promotion of Engineering Education who indicate a desire and willingness to affiliate and work with the Division.

3. The Division of Mechanical Engineering shall include the following major subdivisions, and such additional subdivisions as shall be deemed necessary and expedient, and be authorized by the Executive Committee of the Division:

(1) Manufacturing Materials and Processes.
(2) Heat Power.
(3) Machine Design.
(4) M. E. Laboratory.

4. The administration of the Division shall be by an Executive Committee to be comprised of a Division Chairman, Division Secretary, and the Chairman of each of the major subdivisions.

The Chairman of the Division shall retire at the end of each annual meeting. He will be automatically succeeded by the Division Secretary. A new Division Secretary shall be elected by secret ballot by the members of the Division, present at the annual meeting, from the retiring subdivision Chair-

men. The one receiving the highest number of votes will become the Division Secretary.

The administration of each subdivision shall be by an Executive Committee to be comprised of a Chairman, a Secretary, and one other member. At the end of each yearly period, the Chairman of each subdivision shall retire and be automatically succeeded as Chairman by the Secretary, who, in turn, shall be succeeded as Secretary by the third member of the Committee. A new member of the Executive Committee of each subdivision shall be elected from nominations made by the members of the subdivision at the time and place of the annual meeting.

5. All activities of the Division shall be prescribed by the Executive Committee of the Division.

Again let us urge anyone who can contribute to any of the following broad topics, do so.

1. Mechanical Engineering as a Profession.
2. The Selection and Guidance of Students into Mechanical Engineering.
3. Mechanical Engineering Education.
   - *a.* Objectives.
   - *b.* The curriculum.
   - *c.* Course content.
   - *d.* Methods.
   - *e.* Students.
   - *f.* Faculty.
   - *g.* Functional education.
   - *h.* Extra-curricular activities.
   - *i.* Achievement testing.
   - *j.* Comprehensive examinations.
   - *k.* Research.
   - *l.* Administration.
4. Mechanical Engineering student placement and follow-up.

Questions, discussions, ideas sent in on these topics can be of prime help to the committees in building up vital and interesting programs for annual meetings, as well as contributing to the notes.

THE EDITOR

THE T-SQUARE PAGE

DEVOTED TO THE INTERESTS OF THE
DIVISION OF ENGINEERING DRAWING

A. W. LEIGHTON, *Editor*, Tufts College

QUALITY DRAWING INSTRUMENTS FOR ALL STUDENTS

Even today many students entering engineering colleges have never seen drawing instruments, and without being very facetious one might say the same of a great many more, for they have seen only imitation instruments. What any one of them knows of the quality of instruments is nil, and what most of them learn while in college is open to criticism. If any one doubts this, let him conduct a little investigation for himself right among his colleagues in the other departments of the engineering college. In fact if we examine ourselves it may not be necessary to go farther. That this is not news to us is evidenced by the fact that the drawing division has had a committee making a study of drawing instruments, and when the findings of this committee are in our hands we shall, no doubt, be in a better position to pass sound judgment. However, we shall still be faced by the student from high school with instruments that fall short of our estimate of minimum requirements, and this will likely prove to be a problem with a more complex, and a more difficult, solution.

The manner in which we attack this problem will vary as will the standard of our minimum requirements in the instruments. And it is not without trepidation that I offer, what seems to me, a possible solution. The students who bring instruments from high school, and those who have purchased before consulting their instructors at college, have spent money that is just as real as though it had been applied on better instruments and the amount is likely to be twenty per cent or more of the cost of acceptable instruments. It simply does not make engineering sense to throw away that much money without first giving the material a trial to see if it will work. And it does not make any kind of sense to most parents to give twenty to forty dollars to find out whether son is going to like mechanical drawing or not while he is in high school.

Then considering the number of students who discontinue engineering after the first semester or year, it puts drawing in a rather unfavorable position for comparison with mathematics or English in cost per credit-hour. This will naturally retard, or possibly continually prevent general engineering drawing and descriptive geometry from being accepted for credit toward a degree of bachelor of arts or science, when they have fully as much cultural value in our modern civilization as do algebra or chemistry.

Since it is apparent that the cost should be reduced, and since drawing instruments are the most expensive item, and good instruments command a good price, is it not possible that the more or less standard nine-piece set is quantitatively too high a requirement? Furthermore, the majority of our students do not go into drafting, and if they did, they would need to buy

several special instruments peculiar to their immediate work, while most of their nine-piece set would be put away among their souvenirs of college days.

In the past five years I have demonstrated to my satisfaction that a six-inch compass with a pen piece and lengthening-bar is sufficient for my beginning students. Those students who continue in engineering usually build to their compass and if they would come from high school with a good compass instead of the impossible stuff they usually bring, by the time they finish college they could build a set of good instruments to suit their needs in their chosen field without straining their finances at any particular time.

But perhaps after all, the student, impressed with the value of quality in his professional equipment, who accumulates a set of good instruments by wisely buying piece at a time as he finds the need for it, will make no better engineer than the boy who one day, finds himself with a box full of shiny new gadgets and a set of exercises that he may learn how to use them, provided he should ever have need for them.

JOHN HENRY BUTLER,
Assistant Professor of Mechanical Engineering,
New Mexico State College.

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The National Drawing Competition Committee will welcome problems and suggestions for the coming competition. Please send these immediately to the Chairman, Stanley G. Hall, 314 Transportation Building, University of Illinois, Urbana, Illinois.

COLLEGE NOTES

Case School of Applied Science.—New faculty members are Paul L. Hoover, David Turnbull, Jr., and Merril L. Riehl. Dr. Hoover is the new head of the department of electrical engineering and replaces Professor H. B. Dates, who is now devoting his full time to the Evening Division. A native Ohioan, having been born in Mansfield, Ohio, forty years ago, Dr. Hoover has completed studies at Carnegie Institute of Technology and the Universities of Vienna and Paris in Europe. After his return from abroad he spent three years at Harvard as Research Fellow. He was appointed to the Case faculty in 1927 as Associate Professor of Electrical Engineering and remained at this post until 1930 when he went to Rutgers University as Assistant Director of the Engineering Experiment Station. In 1934 he was appointed director, a position he held until the present.

David Turnbull, Jr., a native of Kewanee, Illinois, will assume his duties as Instructor in Chemistry. After graduation from Monmouth College, Dr. Turnbull entered the graduate school of the University of Illinois and completed the work for his doctorate in June. He has specialized in Physical Chemistry and will assist Dr. S. H. Maron in both teaching and research work in this field. Merril L. Riehl will also become a member of the chemistry department as an Instructor. He was born in Columbus, Ohio, and attended Ohio State University where he majored in Chemical Engineering. He has had three years of practical experience at the Columbus Water Purification Works and at Case will assist in teaching the new courses in sanitary engineering.

Two members of the faculty will also be welcomed back after a year's leave of absence. Robert Shurter, instructor in English, has spent the past year as an exchange professor at Massachusetts Institute of Technology. Charles C. Torrance, instructor in Mathematics, returns to Case this year after a year spent in advanced study and research at the Institute for Advanced Study at Princeton, N. J.

Colorado School of Mines.—Enrollment for this semester is about the same as last year's enrollment. The freshman class is smaller because of higher scholastic standards, but the number of upper classmen has increased. The senior class, numbering 150, is the largest in the history of the school.

A national survey of the employment expectancy of graduates of educational institutions conducted by a New York newspaper indicated 100 per cent employment for graduates of the Colorado School of Mines. This percentage of employment has been verified by administrative officials here, all 133 members of the class of 1939 being employed in their chosen fields.

Enrollment in the summer school and field work during the past summer was the largest in the history of the school. Of a total registration during the year 1938–39 of 828, 634 men were in summer school or summer field work, a 14 per cent increase over the enrollment the preceding summer.

New members of the faculty are John C. Haff, assistant professor of geology, replacing Ben Parker, who is on leave of absence; James R. Cady, instructor in metallurgy, replacing J. Ross Reed; and Charley Esslinger, instructor in physical education and freshman coach, replacing Elwood Romney. Mr. Haff, formerly instructor in mineralogy, petrography, and economic geology at the University of Wichita, is a graduate of Long Island College, has the A.B. and M.A. degrees from Columbia University, where he has also completed the academic qualifications for the Ph.D. He has had a year of advanced study as William Bayard Cutting Traveling Fellow at the University of Innsbruck and Eidgenossischen Technische Hochschule, Zurich. Mr. Cady is a graduate of Texas College of Mines, and has done graduate work at Leland Stanford and at the University of Mexico. Mr. Esslinger is a graduate of Oklahoma A. & M., and has had successful experience as a high school coach in Nebraska.

The new $175,000 housing project for faculty members and married students has been completed and is now fully occupied. The project comprises 31 apartments and houses, all having the most modern equipment. Landscaping of the premises will be completed within the next few months.

Harvard University.—To aid national defense and commerce, a new department of Aeronautical Engineering will be started by the Harvard Graduate School of Engineering this fall, offering advanced study and research opportunities in airplane design. Work began at the opening of the academic year, September 25. Plans had been discussed to open the aeronautical engineering division next year, but arrangements were speeded during the summer to permit a start this fall instead. Men completing the new Harvard course will be prepared for work as aeronautical engineers in aircraft factories or research institutions.

Centered principally about Harvard's new wind-tunnel, constructed last year, the aeronautical course as now planned will

offer two years of graduate work in applied aerodynamics, airplane design, airplane structure, internal combustion engines, applied mathematics, vibrations and advanced dynamics, advanced aero- and hydro-dynamics, advanced theory of elasticity, and research. Elective studies will also be available in meteorology, in the commercial aspects of air transportation, and other related fields. Students will have use of the dynamics laboratory and the materials and structures laboratory of the Graduate School of Engineering. The work will be entirely on a graduate level, as in other departments of the School, and a college bachelor's degree will be required for admission.

Directly responsible for the new department of aeronautical engineering will be J. P. Den Hartog, Associate Professor of Applied Mechanics; and William Bollay, Instructor in Applied Mechanics, designer and builder of the Harvard wind-tunnel.

Associated in the instruction will be Richard de Mises, newly appointed Lecturer on Applied Mechanics at Harvard, an authority on applied mathematics and aeronautics. Formerly Professor of Applied Mathematics at the University of Berlin, Dr. de Mises founded and edited the (German) Journal of Applied Mathematics and Mechanics, and later founded and directed the Institute of Mathematics, Istanbul University.

Johns Hopkins University.—The curricula of the night courses in Technology have been revised and now parallel the courses in the Day School. New Bachelor of Science degrees have been established for the following curricula offered in the Night School: Aeronautical, Chemical, Civil, Electrical, Gas, Industrial and Mechanical Engineering and in Chemistry and Physics. Over 700 students registered in this School last year.

Professor A. G. Christie of the Mechanical Engineering Department and President of the American Society of Mechanical Engineers has been given an Honorary Life Membership in the Institution of Mechanical Engineers of London, England in view of his eminent scientific attainments. He is the third American to be honored. The others are Alexander Dow and Henry Ford.

The **Missouri School of Mines and Metallurgy** started the year with another record enrollment, the increase being approximately 12 per cent over that of the first semester of last year and totaling 840 registered. This new enrollment is crowding the school facilities to the utmost. The first section of Harris Hall, the new Civil Engineering building, has been occupied in order to provide space for the students even though only about one-third of the building is complete. The last session of the Missouri Legislature authorized

a $250,000 appropriation for the construction of a new Chemical Engineering building. About one-third of this amount has been released by the Governor, but construction work on the new structure has not yet begun.

The following have been added to the faculty: Ivan C. Crawford, Jr., B.S. in C.E., M.S. in C.E., Instructor in Civil Engineering. H. T. Mann, B.S. in Mining, Dr. Science, Professor of Petroleum Engineering. C. E. Henderson, Cer.E., Instructor in Ceramic Engineering. G. R. Guinnup, B.S. in M.E., M.S. in M.E., Instructor in Mechanical Engineering.

New York University.—The Graduate Division of the College of Engineering will confer for the first time the degree of Doctor of Engineering Science at the conclusion of the 1939–40 academic year. The degree, approved by the New York State Board of Regents of New York State, and the Council of the University, is the first of this type to be offered by an accredited engineering school in the United States. There are fourteen candidates for this degree now enrolled in the College.

Northeastern University.—The College of Engineering made several important additions to its laboratory facilities during the past summer. Among the new installations in the Department of Mechanical Engineering are a 300,000-pound Riehle Hydraulic Universal Testing Machine of the latest design, a 24-foot Venturi-type wind tunnel with three-foot test section—maximum wind velocity of 100 miles per hour—and equipped with three component balances, a fluid flow analyzer for the study of air flow around two dimensional models, and several makes and types of Diesel engines.

In the Electrical Engineering Laboratories there has been installed a 12.5 k.w. steel tank mercury arc rectifier arranged for double three phase operation. Starting panel, all necessary pumping equipment, McLeod vacuum gage, and a special phase shifting device for controlling the output are included with this unit. The department has also acquired a new 10 h.p. General Electric B. T. A. brush shifting variable speed alternating current motor and a General Radio Inductance Bridge, Type 667A.

Substantial additions have also been made to the laboratory equipment in chemistry and chemical engineering and in biology. A course in General Biology, with laboratory work, designed especially as a liberal elective for engineering students and including an introduction to both zoology and botany will be offered for the first time this year by Dr. Stanley D. Miroyiannis, chairman of the Biology Department.

Other liberal courses developed especially as electives in the engineering curriculum are American Government, Shakespeare,

the Short Story, History of Art, European History Since 1820, and Educational Psychology. A course in Metallography will be introduced this year as part of the required course for all Mechanical Engineering students. It is also planned to introduce an optional course in aerodynamics in the second semester of the junior year in this curriculum.

Several new appointees joined the engineering faculty this fall. Robert W. Cole, S.B., M.S., Purdue University, has been added to the Department of Mechanical Engineering as a graduate assistant. Gustav Rook, a graduate with honor from the Department of Electrical Engineering at Northeastern, has returned to the College as an instructor in drawing. R. Lawrence Capon, a graduate of the New England Conservatory of Music and of Boston University, has been appointed instructor in English. Mr. Capon holds the degrees of A.B. and A.M. from Boston University.

Several promotions on the engineering faculty also become effective this fall. Emil A. Gramstorff has been promoted to Professor of Civil Engineering and Chairman of the Department, succeeding the late Henry B. Alvord. To the Department of Civil Engineering have been transferred James J. Devine and Albert E. Sanderson, both of whom have served on the Northeastern faculty previously in the Department of Drawing. Professor William C. White has been appointed Assistant Dean of Engineering. Other promotions include Wayland S. Bailey from Instructor to Assistant Professor of Mechanical Engineering; Chester P. Baker from Associate Professor to Professor of Chemical Engineering; Stanley D. Miroyiannis from Assistant Professor to Associate Professor of Biology; George W. Pihl from Graduate Assistant to Instructor in Electrical Engineering; Chester H. Wolowicz from Graduate Assistant to Instructor in Mechanical Engineering.

The College of Engineering now has thirty members of the S. P. E. E. on its faculty and this fall formed a Northeastern University branch of the Society with the approval of the S. P. E. E. Council. Professor C. P. Baker was elected first chairman of the branch and Professor W. T. Alexander secretary. Plans are being made for an interesting series of meetings during the coming year.

University of Notre Dame.—Dugald C. Jackson, Jr., was appointed dean of the college of engineering. Dean Jackson assumed his new duties coincident with the opening of Notre Dame's ninety-eighth scholastic year, Sept. 14th. At the same time, Professor Carl Wilcox took charge as head of the department of mechanical engineering, succeeding Professor William L. Benitz, who retired last spring.

Other engineering faculty changes include the addition of James A. McCarthy, formerly of the United Fruit Company and the Massachusetts Institute of Technology, to the department of civil engineering; Robert C. Egry, formerly of the University of Detroit, to the department of mechanical engineering; and Alexander R. Troiano, formerly of Harvard University, to the department of metallurgy.

NECROLOGY

CLEMENT ROSS JONES, retired head of West Virginia University College of Engineering, died August 16, 1939. Dean Jones was born in Knottsville, W. Va., on April 19, 1871, the son of Uriah and Pernissa Jane Ford Jones. He entered West Virginia University as an engineering student in 1890, receiving the degree of B.S.C.E. in 1894; M.E. in 1896. He also attended Worcester Polytechnic Institute in the summer of 1896 and Stevens Institute of Technology in the summer of 1897.

He was an assistant in mechanical engineering in 1895–97 and instructor in 1897–99. He obtained a leave of absence to attend Cornell in 1900 and received the degree of M.M.E. the following summer. In 1901 he was elected professor and head of the department of mechanical engineering at West Virginia; in 1911, Dean of the College of Engineering which position he held until his retirement as Dean Emeritus in 1932. He is regarded as creator of the college to which he gave his life.

Dean Jones was internationally known as an engineering educator and also as a practical mechanical engineer. He was for years Secretary of the Engineering Section of the Association of Land Grant Colleges and Universities. He was a member of the S. P. E. E., West Virginia Society of Professional Engineers, the A. S. T. M., and the A. S. M. E.

NEW MEMBERS

BRINKER, WILLIAM E., Associate Professor of Chemical Engineering, University of Pittsburgh, Pittsburgh, Pa. F. L. Bishop, Nell McKenry.

DUSINBERRE, GEORGE M., Assistant Professor of Mechanical Engineering, Virginia Polytechnic Institute, Blacksburg, Va. J. B. Jones, J. I. Clower.

HARRIS, CHARLES O., Instructor in Mechanics, Armour Institute of Technology, Chicago, Ill. J. B. Finnegan, John C. Penn.

KLEINSCHMIDT, ROBERT B., Instructor in Civil Engineering in Undergraduate Centers, The Pennsylvania State College, Pottsville, Pa. F. T. Mavis, H. P. Hammond.

KYLE, PETER E., Assistant Professor of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. Carlton E. Tucker, A. L. Townsend.

LUCAS, ERNEST L., Associate Professor of Mechanical Engineering, Mississippi State College, State College, Miss. L. L. Patterson, H. C. Simrall.

MILLER, CLARK O., Assistant Professor of Chemical Engineering, Case School of Applied Science, Cleveland, Ohio. K. O. Thompson, H. R. Young.

MILLER, JOHN L., Associate Professor of Metallurgy, Armour Institute of Technology, Chicago, Ill. J. B. Finnegan, B. B. Freud.

PERRY, JOHN H., Technical Investigator, E. I. duPont de Nemours & Co., Wilmington, Del. T. H. Chilton, A. P. Colburn.

SCHULTZ, FLOYD V., Instructor in Electrical Engineering, Michigan State College, East Lansing, Mich. M. M. Cory, L. S. Foltz.

WHITE, WALTER T., Assistant in Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. Carlton E. Tucker, E. L. Moreland.

WILLIAMS, BERT B., Assistant Professor of Civil Engineering, The Citadel, Charleston, S. C. L. S. LeTellier, C. W. Dunham.

WILSON, HAROLD A., Assistant Professor of Mechanical Engineering, Rensselaer Polytechnic Institute, Troy, N. Y. John G. Fairfield, James J. Devine.

WOLOWICZ, CHESTER H., Instructor in Mechanical Engineering, Northeastern University, Boston, Mass. Jos. W. Zeller, Robt. W. Cole.

SECTIONS AND BRANCHES

Northeastern University.—At the organization meeting of Northeastern Branch, Chester P. Baker, Head of the Department of Chemical Engineering, was unanimously elected chairman for the current year, and William T. Alexander of the Department of Industrial Engineering, secretary.

BOOK REVIEWS

Engineering Opportunities. R. W. CLYNE, Editor. D. Appleton-Century Co., Inc., New York and London. xxv. 378 pp. $3.00.

"An extremely helpful and interesting guide book for those who wish to enter or learn more about engineering. More than twenty-five engineering opportunities are described by representatives of leading American companies."

The foreword by President Compton of Massachusetts Institute of Technology, defines engineering, differentiates the engineer from the technician, and sketches the development of successive divisions of application as science advanced.

Emphasis is placed on the proper balance of scholarship, broad interests and human culture or the ability to coöperate with others.

The place of the engineer in our economic and social organism, his increasing importance and the ever-broadening field to which he is called are supported by evidence and constitute a most inspiring message.

The twenty-six chapters describe fields or industries, commencing with *Aluminum,* including *Food Technology, Glass, Photography, Plastics,* the *Rubber Industry,* and *Mechanical Vibration,* in addition to the usual fields.

The space devoted to an industry varies from seven pages for *Glass* to twenty-five pages for *Aviation* and averages about fifteen. The chapters are clear, informing and attractively written. Some are inspiring, such as the one on *Railway Equipment,* by L. K. Sillcox; the one on *Architecture* and *City Planning* by Henry S. Churchill, is prophetic and economic. *Building Construction* by R. A. Bisson, is also very modern in its outlook. The chapters on *Plastics* and *Mechanical Vibration* are attractively written and highly informing. Some are matter-of-fact; others picture the industry attractively. There is little about education—not training —except in the chapter on the *Automotive Industry,* which latter is of real value to the enquiring high school boy.

Personal qualities are mentioned here and there. The essentials of management are presented in the chapter on *Industrial Engineering.*

R. L. SACKETT

Direct Current Machinery. H. S. BULL. John Wiley & Sons. 317 pages. Price $3.00.

The book has been divided by the author into 16 chapters. In addition there is an appendix and an index. The first chapter is given over to fundamentals mainly of torque, e.m.f. and Ohm's law. Before expanding on these ideas in later chapters the author devotes the second chapter to electrical instruments. A study is then made of the direct motors which includes starting, speed regulation and control. Before studying generator characteristics, the student is introduced to a study of the magnetic circuit with topics such as difference of magnetic potential, B–H curves, magnetic circuits, inductive circuits and other relations. Following the study of the commonly used types of generators, there will be found chapters dealing with windings, losses, armature reaction, parallel operation and special generators. Rating and cost and a well balanced presentation on electric circuits comprise the two final chapters.

The book contains several hundred problems which are distributed at the end of most of the chapters. These problems represent a fine selection on this subject. The chapter on armature reaction is noteworthy in bringing out magnetic field patterns of conductors and resultant mmf's. The author has correlated the presentation of the various factors of commutation. In contrast with certain texts graphical methods of predicting performance characteristics are not stressed.

R. W. AHLQUIST

Heat Power. Second Edition. EARLE B. NORRIS AND ERIC THERKELSEN. McGraw-Hill Book Company, Inc. 432 pages. $4.00.

In common with other books in this field revision is used to emphasize recent important developments in power engineering and to reduce the discussion of less important features.

As might be expected, the chapter on boilers shows particularly the effect of revision. The following have been added: a chapter on refrigeration, a combustion calculation outline, and answers to the problems. Steam tables and data on specific heat of gases conform to the latest experimental data that are available.

These changes should make the book a more valuable reference for the student. They should aid the teacher, because not so much material will have to be introduced and fully explained by lecture without previous study on the part of the student.

G. O. MANIFOLD

OFFICERS, COUNCIL MEMBERS, AND COMMITTEES OF THE SOCIETY FOR 1939–1940

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COMMITTEES FOR 1939–40

Conferences: D. B. Prentice, Rose Polytechnic Institute, Terre Haute, Ind., in charge of all conferences for 48th annual meeting at the University of California, Berkeley, Calif., June 25–28, 1940.

Executive: O. J. Ferguson, Chairman, University of Nebraska, Lincoln, Nebr., D. B. Prentice, R. W. Sorensen, F. L. Bishop and W. O. Wiley.

Publication: F. L. Bishop, Chairman, K. T. Compton and O. J. Ferguson.

Program: O. J. Ferguson, Chairman, D. B. Prentice, R. W. Sorensen, F. L. Bishop and W. O. Wiley.

Nominating: All Past Presidents and those members of Council whose terms expire in 1941.

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Relations with Engineering Societies: H. P. Hammond, Chairman, Pennsylvania State College, State College, Pa., H. J. Gilkey, D. C. Jackson and F. L. Bishop.

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Industrial Engineering: C. E. Bullinger, Chairman, Pennsylvania State College, State College, Pa., C. W. Beese, G. W. Barnwell, L. P. Alford, H. G. Thuesen, A. S. Knowles, H. J. McIntyre.

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Instructional Methods: Carl S. Ell, Chairman, Northeastern University, Boston, Mass., W. M. Cobleigh, A. B. Domonoske, H. J. Gilkey, Louis Mitchell, T. H. Morgan, W. L. DeBaufre.

Physics: C. G. Watson, Chairman, School of Mines, Rapid City, S. D., G. E. Grantham, D. C. Duncan, D. S. Elliott, T. T. Smith, O. W. Silvey.

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Labor Relations: G. L. Sullivan, Chairman, University of Santa Clara, Calif., R. M. Barnes, J. O. Keller, J. W. Dietz, H. L. Davis, Elliott D. Smith, Webster N. Jones.

Comprehensive Examinations: Justus Rising, Chairman, Purdue University, Lafayette, Ind., H. W. Bibber, J. L. Bray, Paul Cloke, R. H. Frazier, C. V. Mann, R. E. Davis, H. V. Carpenter.

Revision of Engineering—a Career—a Culture: D. S. Kimball, Chairman, Ithaca, N. Y., H. H. Armsby, R. L. Sweigert, J. S. Thompson, R. B. Wiley, W. O. Wiley, B. M. Woods, F. L. Bishop.

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Undergraduate Adjustment and Guidance: A. R. Cullimore, Chairman, Newark College of Engineering, Newark, N. J., Paul Cloke, B. M. Woods, O. M. Leland, Bradley Stoughton, A. H. Lovell.

Development and Placement of Engineering Graduates: J. R. Bangs, Chairman, Cornell University, Ithaca, N. Y., L. M. K. Boelter, M. M. Boring, P. H. Daggett, O. W. Eshbach, O. A. Leutwiler, F. A. Magoun, J. E. McDaniel.

Lamme Award: J. H. Belnap, Chairman, Westinghouse E. & M. Co., Pittsburgh, Pa.; for four years, J. H. Belnap, A. C. Stevens, General Electric Co., Schenectady, N. Y., B. G. Elliott, University of Wisconsin; for three years, F. C. Bolton, A. & M. College of Texas, C. E. Bullinger, Pennsylvania State College, F. L. Plummer, Case School of Applied Science; for two years, D. C. Jackson, 5 Mercer Circle, Cambridge, Mass., R. C. Ernst, University of Louisville, H. B. Langille, University of California; for one year, G. W. Case, University of New Hampshire, R. E. Freeman, University of Kentucky, H. S. Evans, University of Colorado.

Membership: J. W. Haney, Chairman, University of Nebraska, Lincoln, Nebr., J. A. C. Callan, O. Dahlene, J. C. Clark, B. N. Wilson, H. B. Langille, H. B. Walker, V. C. George, P. S. Biegler, A. G. Gehrig, A. B. Domonoske, J. B. Phillips, A. R. Zimmer, A. Frigon, W. E. Lovell, W. C. DuVall, N. A. Christensen, A. S. Adams, H. M. Turner, W. L. Edel, R. L. Spencer, N. C. Ebaugh, R. L. Sweigert, A. R. Keller, J. E. Buchanan, R. C. Kintner, F. A. Rogers, H. S. Philbrick, A. N. Talbot, J. E. Walters, F. W. Horan, C. Wischmeyer, M. S. Coover, E. L. Waterman, E. R. Dawley, J. A. King, C. C. Jett, F. L. Wilkinson, B. W.

Pegues, G. G. Hughes, J. M. Robert, Paul Cloke, W. B. Kowenhoven, S. S. Steinberg, A. S. Knowles, F. G. Willson, J. P. Den Hartog, K. T. Compton, R. Abbott, T. H. Morgan, A. H. White, C. J. Freund, A. R. Carr, W. W. Hitchcock, Jas, Fisher, O. S. Zelner, L. L. Patterson, A. C. Lanier, I. H. Lovett, A. S. Langsdorf, W. M. Cobleigh, F. A. Thomson, F. H. Sibley, O. T. Zimmerman, W. P. Kimball, W. D. Ennis, F. D. Carvin, P. H. Daggett, J. C. Elgin, M. E. Farris, D. B. Jett, L. F. Rader, C. C. Carr, J. R. Bangs, S. J. Tracy, T. T. Read, E S. Burdell, Bro. A. Leo, L. V. Carpenter, F. C. Wilson, W. J. Conley, W. C. Taylor, Louis Mitchell, E. A. Fessenden, H. C. Bird, B. R. Van Leer, H. S. Rush, I. Lavine, C. R. Upp, W. M. Young, C. W. Park, K. O. Thompson, D. C. Fabel, S. A. Harbarger, M. E. Haas, D. M. Palmer, W. F. Cloud, P. S. Donnell, C. A. Mockmore, J. R. Connelly, W. B. Plank, W. K. Rhodes, J. B. Baker, J. A. Goff, W. R. Work, R. F. Edgar, C. L. Kinsloe, H. S. Bueche, R. L. Wales, W. H. Kenerson, L. S. LeTellier, D. H. Shenk, B. M. Aldrich, J. O. Kammerman, R. M. Boarts, F. G. Slack, H. E. Degler, H. C. Dillingham, R. D. Landon, A. H. Burr, H. L. Kipp, A. L. Taylor, G. F. Eckhard, F. A. Spencer, P. T. Norton, J. A. Anderson, J. L. Vaughan, O. E. Osborn, E. A. Loew, G. P. Boomsliter, K. F. Wendt, F. A. Kartak, G. H. Sechrist.